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PREFACE

TO THE FIRST EDITION.

In presenting the following pages to the Public, introductory remarks are scarcely needed, as the book is one of a kind that speaks its purpose with singular plainness.

The object has been to produce for the rising generation, at a price within the reach of most, a practical description of such Pastimes as, while they afford a never-ceasing source of amusement, are calculated equally to enlarge the mental and physical powers. In carrying out this design, the beaten course has not only been followed, but the modern sciences have been made to render tribute; and the reader will consequently find many items of information in this little volume that he may look for in vain in works of greater pretension.

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TO BOYS.

Begin in early life to collect Books for yourselves. Begin with a single Book; or, when you find or hear of a first-rate Book, obtain it if you can. After a while, get another, as you are able, and be sure you read it. Take the best care of your Books; and in this way, when you are men, you will have good libraries in your heads as well as on your shelves.

THE

ANGLER'S GUIDE.

NOTWITHSTANDING the many sarcasms that have been thrown out by a variety of authors against the practice of angling, there are a number of circumstances, independent of the natural predilection which many evince, that concur to render the diversion more extensively practised than most others. Angling, indeed, has long been the particular amusement of the Londoners; and it is this, together with the superiority of their tackle, and the comparative scarcity and shyness of the fish in the waters frequented by them, that renders the London angler much superior in point of skill to the provincial sportsman, in every department except fly-fishing: here it is that the London angler fails, through want of practice, there being few really good trout streams near the metropolis, except those which are private property; whilst in Wales, the north of England, and Scotland, every brook literally swarms with these fish, affording to the inhabitants of those parts continual practice of the best kind, no fish living so exclusively on flies during the summer season as the Trout, with the exception of the Grayling or Umber, a fish remarkably scarce in the south.

The first thing to be attended to by the angler is the necessary apparatus, consisting of rods, lines, winches, floats, hooks, landing-net, plummets, baiting-needles, clearing-ring, split shot, two or three leger-leads, a pair of pliers for putting shot on a line, caps for floats, kettle for live bait, a pannier or basket for ground bait, gentle-boxes, bag for worms, bank-runners, a piece of shoemaker's wax, a bit of soft leather, and a small piece of wet stone for sharpening blunt hooks; also, a pocket-book of fishing-tackle, with a reel to hold lines.

The Rod.—As the angle-rod is a material article in the angler's catalogue, much care should be taken to procure a good one. The fishing-tackle shops keep a great

variety, made of bamboo cane, hazel, hickory, &c.; but there is little dependence to be placed on them. The only one I should recommend is Mr. Turpin, of the New River Head, Sadler's Wells; you may there be supplied with a rod of any length and material, and may rely upon its being a good article. Rods are of different lengths, some fitted as walking-canes, and others to pack in canvass bags: the latter are to be preferred, because you may have them of any length, and they are made more true: those made of bamboo cane are best for angling near town, having several tops of various strengths; but the rods made of the white cane are much superior for fine fishing, particularly for roach being very light in weight, but stiff. In choosing a rod, observe that it is perfectly straight when all the joints are put together, and that it gradually tapers from the butt to the top, and is eighteen feet long. A bad rod is liable to snap in striking a heavy fish. Rods fitted with several tops, all packing together, are at once the best and most convenient. Some anglers have one rod for trolling, another for barbel, perch, or other heavy fish, as well as those for fly-fishing, but a thoroughly good rod will suit all purposes. I have now one with which I can fish from a Bleak to a Pike by only changing the tops and second joints. A good trolling-rod should be made of the choicest stout and well-seasoned bamboo cane; in length, it should not be shorter than fourteen feet, but sixteen is more desirable. When trolling with the gorge or fishing with live-bait, a long rod is necessary to enable the angler to drop in his baited hook over high sags, rushes, &c.; as also if the water be bright, for he should then keep as far away from it as he possibly can, which a long rod enables him to do while dipping, casting, or spinning his bait. If either a Jack or Pike see him, it is very rare indeed that he will then take the bait: and again, with a long rod you will be able to drop your baited hook in some very likely place for Jack or Pike, such as a small hole, division, or clear place among a bed of weeds, in a river, or any other water where there are many weeds.

There is some difference of opinion among anglers about the number of rings necessary for trolling-rods; those who have their line on a thumb-winder, or on a

bank-runner, seldom place more than two or three rings on their rod, and others have only one large ring at the top; but if a winch is used, there should be a ring to every joint except the butt; that is, fasten the winch to the butt about a foot from the bottom, and let that joint be without a ring, each made of double brass wire, fixed so as always to stand out, and nearly large enough to admit the top of your little finger; the top joint should have two rings, the top one nearly three times the size of the others: this prevents any obstruction to the line running, which is of material consequence.

Lines.—Fishing-lines are made of gut, twisted horse or cow hair, and single horse hair, also of silk or mohair; those made of gut are the strongest and best (especially for young anglers), the twisted hair cheapest, and the single horse-hair the finest. Bad lines are liable to twist in the water. You may make a fine line having half single hair at bottom, the other part two hairs twisted. The gut, or silkworm gut, is made or manufactured from the intestines or gut of the silkworm, and is the strongest substance, for its circumference, known by the angler, and makes a line superior to any thing else; the natural colour of which is better than much that is stained. The young angler will find a line of about four yards in length the most useful, either to fish with or without a winch, as he must note that the line is unmanageable if longer than the rod. Note, in shotting the line to sink the float, place them both together within three inches of the bottom loop of the line, to which loop fix the loop of the hair or gut that the hook is tied to. Place two small shots (the smaller the better) about two inches from the hook, which will cause the bait to swim well and steadily, and the rest above the first loop. When you place shot on the line, do it with a pair of pliers, which is the best and easiest method; some fasten them with their teeth, but it is a bad practice, for they often bite the hair or gut through, which causes much delay and vexation, particularly if it happens when you are fishing. When you make a line, either of silk, gut, or hair, it always must be finest at bottom where the hook is fastened, very gradually increasing in bulk or thickness to the top.

Many good fish are lost after they have been fairly hooked, by the hook breaking or straightening; therefore make it a rule to try the strength of your hooks before you tie them on or use them. A real well-tempered hook will neither bend nor break. Small hooks may be tried by holding one between the fore-finger and thumb of each hand by their shanks, and hooking the bended parts together, and pulling and jerking one against the other. Some anglers tie the line and the length which is fastened to the hook together, instead of using loops, which is a neat way, but bad. In respect to the advantage arising from angling with lines made of single horsehair, and hooks tied to the same, over those which are made of fine gut, some difference of opinion exists among anglers. The advocates for gut say, when it is equally fine and of the same colour as horse-hair, it is not likely to alarm fish more than horse-hair, and being much stronger, it certainly deserves the preference. This seems plausible; fish may be taken, when angling with a single hair line (especially roach), that will not touch the bait when offered with a gut line, though the line shall be as fine and of the same colour, &c. as the hair line. A single hair line, with a small porcupine float, is preferable for general fishing. The platted silk lines are the best for trolling, in every sense of the word; they are stronger than those which are twisted. Let the twisted be made wholly of silk, or silk and hair. Platted silk lines are also less inclined to link or tangle than the twisted, which every troller knows is of some consequence.

To fasten the Rod to the Line.—Pass the loop of your line through the ring at the extremity of the top joint of your rod, carry it over the ferrule end, and then draw your line up to the top again; the loop will then be fast, and the line will hang from the above-mentioned ring: you will then put the joints of your rod together, and the rod and line will be complete. Most experienced anglers keep about six or eight inches of fine silk line tied to the end of the top joint, and fasten the gut or hair line to the said six or eight inches of silk, by a draw loop-knot: this is an excellent method, because the ring is apt to chafe gut or hair. When you have a winch on your rod to use running line, pass

the said running line from the winch through every ring on the rod, and pull about a yard of it through the top ring, and fasten it with a draw loop-knot to the line which has the float and hook to it. When you angle with a running line for those fish that it is proper to strike the instant you perceive a bite, make a slip-knot in the line, and put in the said knot a bit of thin stick, quill, or tough grass, about an inch long, to prevent the line running back on the rod, which it will do, especially if the wind is any way in your front.

To tie a Hook.—Hold the hook between the thumb and finger of your left hand, and whip round the shank, from the bend of the hook to the top, some fine silk waxed with shoemaker's wax; then lay the hair or gut on it, and whip it over very close with the waxed silk, from the top of the shank till you come opposite the point of the hook; then draw the silk through the loop which is made by leaving it three turns slack, and cut off the spare silk. The knot used in making fishing-lines is called a water-knot, and is made by passing the ends twice over and then drawing them tight; this knot will never draw or slip.

Floats.—With regard to floats, it is of the first consequence that the angler should be acquainted with those proper for fishing in different waters, and for various kinds of fish; as more depends upon that part of his tackle, than inexperienced or superficial observers imagine. I shall, therefore, request his attention while I point out those proper for the purpose:—

The Tip-capped Float.—These floats are made of several pieces of quills, or of reed for the middle, and ivory or tortoise-shell at the top and bottom, and narrow at each end, gradually increasing in bulk or circumference to the middle; but those which are made thickest above the middle, nearest the top, swim the steadiest in blowing weather, against the stream, rough eddies, and at the tail of mills: these floats are fastened to the line with a cap at each end. Tip-capped floats are superior to every other for angling in waters which are not very rapid, particularly in roach fishing, as the least movement or fine bite sinks it below the surface of the water. The tip-capped float is also best for pond fishing for carp and tench; as it requires but few shot

to sink it, and consequently disturbs the water but little when cast in; which is of the first consideration when angling for such shy fish as carp, tench, or chub. Note, the caps which fix the lines to the float are often rough at the edge, which chafes and weakens a fine line; therefore, make it a practice to examine and smooth them before you put them to use.

Cork Floats are generally made of quills at the top, with a piece of cork, which is burned or bored through the middle, to admit the quill, and then filed or ground smooth, and painted: the bottom is plugged with wood and a ring to let the line pass through. The cork floats are well calculated to fish in heavy and rapid streams, as they require a great many shot to sink them; which weight of shot prevents the baited hook passing too quickly over the bottom of the place where you may be fishing; for, with a strong current or stream and a light float, the baited hook goes over the place you have ground-baited, before it reaches the bottom; consequently you lose the greatest chance of success from the float not sinking quickly. Cork floats are made of various sizes and shapes; instead of common quills, some introduce the quills of the porcupine, which makes an excellent strong float. A small cork float, in my opinion, is far the best for Gudgeon fishing.

Plugged Floats.—These kind of floats are the cheapest, and made of indifferent quills; some of them with one goose quill and a wooden plug at the bottom, from which they take their name; they are very apt to loosen by the plug coming out. These floats suit the young angler from their cheapness, and by being easily put on the line, having a cap at the top, and a ring at the bottom; however, the better informed angler objects to the ring at bottom, because it does not keep the line close to the float, and from the resistance or hindrance it makes in passing through the water, particularly when the fish bite fine; therefore he always uses the tip-capped float in ponds or rivers, where the stream will admit, in preference to every other. I must, however, condemn plugged floats altogether, as bad.

To make the Float stand or swim upright in the Water.—Some shot must be put on the line, as already

directed in treating of the hook; they are kept ready split for the purpose, at the tackle-shops; but a perfect angler will buy the shot himself, and with a pair of split-shot plyers split them as he wants them;—let him always prefer small shot. To strengthen a quill float, and to prevent the line slipping after passing the line through the bottom cap, give it two or three twists round the body of the float before you fix the top cap to it.

How to bait a Hook.—To bait a hook with a worm use the following method:—first enter the point of the hook close to the top of the worm's head, and carry it carefully down to within a quarter of an inch of its tail; to do which you must gently squeeze or work the worm up the hook with your left thumb and finger, while with your right you are gradually working the hook downwards; the small lively piece of the worm at the point of the hook moving about will entice or attract fish; but note, if too much of the worm hangs loose, though it may entice fish to nibble, yet they will seldom take the whole in their mouth so as to enable the angler to hook them; on the contrary, he is frequently tantalized with a bite, and when he strikes finds part of the worm gone, the hook bared, and no fish; therefore, to bait a hook well with a worm is necessary to insure hitting a fish when you strike; and it consists in drawing the worm, without injuring it, quite over and up the shank of the hook, leaving only a small lively part of the tail below the point thereof. If you bait with a half or piece of worm, prefer the tail end, and enter the point of the hook into the top part of it, and bring it down nearly to the end of the tail, leaving only a very small piece loose. But if you bait with two worms on a hook, draw the first up above the shank, while you put the second on in the same manner as directed with one worm, but enter the hook near the tail of the second worm, then draw the first one down on the second over the shank of the hook, and all will then be well covered, and will be a very enticing bait for perch, carp, chub, barbel, and all large fish; but when angling for gudgeon or other small fish, half a red-worm is sufficient, and the tail end is best. If blood-worms

are used, put on two or three, in doing which be tender, or you will burst them.

With Gentles.—To bait a hook with a gentle, use this method :—enter the point of the hook into the gentle near either end, and bring it out at the other end, then draw the point back again just within the gentle enough to hide it: if you use more than one, pursue the same method. This is the best way to bait with a gentle whose skin is something tough, especially in cold weather, by piercing the skin in the first instance. By striking fine (when a bite), your hook will enter sufficiently into the fish and secure it, and you do not risk breaking your line or the top of the rod, which frequently happens by striking too hard.

With Greaves.—To bait a hook with greaves is as follows :—first select the whitest pieces from what you have soaked, and put four or five of them on your hook, or as much as will cover it from the bend to and over the point ; these pieces should be about half the size of a sixpence, and put on the hook separately or one after the other,—not a large piece doubled, as some indolent anglers do, for then the hook is prevented entering firmly the fish you strike; whereas, by putting the pieces on separately, when you strike, they either break off or are pushed up the shank, and the whole bend of the hook enters the fish, and you have firm hold. These minutiæ of baiting, &c. are of singular advantage, which the observing angler will not fail to attend to and appreciate. Note : it is a bad practice to boil greaves or soak them in boiling water, for it makes them rotten and soon fall off the hook : they are longer in soaking in cold or cool water, but are then tough.

The Landing-Hook and Landing-Net.—The landing-hook is a large hook which is sometimes barbed like a fish-hook and sometimes plain, fastened on the end of a rod ; this rod is occasionally composed of several pieces which run one within another like a telescope, from which the apparatus is called a telescope-handled landing-hook. A landing-net is small like a purse net, mounted on an iron ring, which is fastened like the landing-hook on the end of a rod or pole.

Plummet.—Plummets are of two kinds, either the

common plummet, or the folding plummet. The folding plummet, which is made of a slip of sheet lead rolled up, is by far the better; and, by neglecting which, many of our young anglers spoil their sport.

Plumming the Depth is done in the following manner: —if a ring plummet, pass the hook through the end, fix the point into the cork at the bottom; if a folding plummet, unfold about two inches of it, pass the hook over its side, and then fold the plummet up again; your hook is now secured from drawing away from the plummet: as success depends much in angling at a proper depth, take due pains, and measure the depth accordingly before you begin fishing. Note: when the plumb-lead touches the bottom, and the top of the float is even with the surface of the water, you have the true depth.

Baiting Needle.—The baiting-needle is used for putting on dead baits for trolling, &c.

Disgorger.—The disgorger is an instrument with a forked top about six inches long, made of bone, iron, or brass. When the fish has swallowed the hook, the forked end of the disgorger is thrust down upon it with one hand, while you hold the line tight with the other, which disengages the hook, and permits it to be easily drawn out. This is the safest way to unhook a fish that has gorged the bait, or got the hook fixed in its throat, because by using violence with the thumb and finger to disengage it, you sometimes break a fine or small hook either at the point, barb, or shank, which causes loss of time and much vexation, in having another hook to put on, to plumb the depth again, &c., *which is all absolutely necessary to be done, or you may as well give over fishing.* But when the fish is hooked through the lip, the angler has only to hold the fish steadily in one hand while with the other he carefully takes away the hook.

Clearing-Ring or *Clearing-Line.*—The clearing-line is made of several yards of strong small cord, to the end of which is fastened a heavy ring of lead or brass; if the hook should get fast to a heavy weed, post, or any thing else, this ring is put over the rod and suffered to go down to the hook: hold your rod in the right hand, the top pointing downwards, and the clearing-line in your left, letting the ring fall on the hook, which, from

its weight, generally clears the hook from what it may have struck into: if not, hold the rod tight, and draw the line sideways and break away. In this case the angler seldom loses more than a hook, if he acts as above directed, but without the assistance of a clearing-ring he frequently loses his float as well as hook and line, and sometimes breaks his top joint. The brass clearing-rings are to be preferred, because they are jointed, and in consequence can be used when the angler has a winch in his rod, in which case the leaden ring could not be passed over the winch.—These useful articles to the angler are to be met with at the fishing-tackle shops.

Drag Hook.—The drag is a piece of iron with three or four stout wire hooks, without barbs, placed back to back, to which is fastened a long packthread line; that is used to draw away weeds that a heavy fish may have got himself or the line among, and also to recover any part of the tackle that may be entangled in weeds, or to take up night lines, trimmers, &c. The landing-hook is, however, infinitely preferable, and not so troublesome. I therefore advise the angler not to use the drag-hook at all, and merely describe it that he may know the meaning of every article he may hear spoken of.

Live-Bait Kettle.—With regard to the live-bait kettle, I prefer one of a long square form to a round one, and have always mine japanned white inside and brown out, as the water is much less agitated in such a shaped kettle when you are carrying it than in a round one, and it is more convenient to carry or pack in a basket, &c. for a journey. To select my bait, instead of putting my hand among the fish, which not only frightens them, but by heating the water makes them sickly and dull, I make use of a very small net, not much more than half the size of those used to take gold and silver fish out of globes; this net I carry very conveniently in my fish kettle, by having a piece of the lid cut away at one corner, where a few inches of the handle of the net projects.

Indian Rubber is of use to rub lines when they become chafed and ragged, as it immediately makes them smooth; by rubbing gut or hair, which has laid in coils, with Indian rubber, it will instantly become straight.

Bank Runner.—The bank runner is mostly used in the day-time, while the angler is fishing for roach, barbel, &c. and is stuck in the bank, the bottom being strong turned wood sharpened for the purpose, with a winder at top for the line, which should be from sixteen to twenty feet long, made of silk trolling-line, thin cord, or platted Dutch twine; but you must have a cork and bullet to the line, and bait with a dace, which should swim a foot or two from the ground, as it will by the aid of the cork.

When you use the rod, hold the line with your left hand, and with your right pass the forked end under the line just above the bullet; you may then place the baited hook in the water where you please by a jerk of the rod; at the same time letting the line go from the left hand.

Man of War Trimmer, called also a Foxhound, is made of a large piece of flat cork about five or six inches in diameter, with a groove to admit the line, which is the same as that used for the bank runner; it is, however, without a bullet, according to circumstances.

Thumb Winder.—Thumb winders are sometimes used instead of winches, but they are extremely inconvenient.

Winches.—The best winches are those to fix in a groove, and are fastened with brass ferrules, made for the purpose, on the butt; because you can fasten such a winch to any sized joint. Be sure to choose a multiplying winch, which will be found infinitely superior to a common one. Always keep your winch unlocked, or purchase a winch without a lock, which you will always find best: because in the hurry of the moment, when you have struck a heavy fish, and the winch is locked, he generally breaks away before you can give line to prevent such an occurrence.

BAITS.

Gentles.—Anglers who live in the country may, if they choose, breed and preserve gentles all the year, in the following manner: get the whole or part of a bullock's liver in October, or the heads of sheep with part of the wool on. Cut gashes in them, and let them be well blown by the flies: when the fly-blows are become full-

grown gentles, put them and the remainder of the liver or heads into a tight cask or tub, having first put into the tub or cask about a peck of fresh mould from the fields, to which add half the quantity of half-dried cow-dung, and then put the same quantity of mould and dung over them; keep them in a cold place; and when the mould, &c. at the top becomes dry, sprinkle a little water over it. Using liver or heads I think less disagreeable than having a dead animal blown by flies; but those who prefer a rabbit, or hare, or cat, or dog, have only to follow the directions given above, and they will have gentles at all times. Those who object to having gentles in their house, may preserve them in the garden, by putting the liver or other substance with gentles, mould, or dung, in a hole about three feet deep; but note—this hole must be plastered round and at the bottom with strong clay, or the gentles will penetrate into the earth to a great distance. I find those bred from rabbits or hares, or heads, less liable to burrow in the earth, because the skin and wool keep longer moist, and also afford them food. When you open the store, do it carefully; for when the cool spring air reaches the gentle, it quickly becomes a chrysalis. Horse-dung is too hot for gentles; but cow-dung nourishes them, as will hog's-dung also, but in a less degree.

Brandlings are found in great numbers in dunghills, particularly in those which have lain some time, and become very rotten: they are used for carp, perch, &c. This worm is striped with red and yellow across the whole body. Brandlings are more used by provincial than by the London anglers; they should be kept several days in moss, to scour out the bitter pungent mixture with which they abound.—Those are the best worms of all.

Red Worms.—Some red worms are found in old dunghills, and they also breed among the bark after it has been used by tanners, and thrown out in heaps; but the principal places where they are found, are the banks of the great common sewers near the metropolis; from which places the tackleshops are chiefly supplied, as those banks close to the water breed lob, marsh, brandling, and red worms, in immense numbers. The red worm, when well scoured, is of a fine bright red colour,

with a knot or belt in the middle; it is the best and most killing worm for carp, tench, barbel, chub, perch, gudgeons, eels, flounders, bream, &c. Too much cannot be said in praise of well-scoured red worms: two on a hook are very enticing to perch, barbel, carp, chub, tench, &c.—indeed, hardly any fish will refuse them, especially during the spring, autumn, and winter; in summer you may use them in the evenings of wet days, because at such times worms move, and the fish then expect them on the banks, from which they frequently drop into the water.

Blood Worms.—This worm, or maggot—for it seems to be covered with a case or chrysalis, and at last becomes a gnat-fly (the smallest used in angling)—is found at the bottom of shallow ponds in cowlayers or yards, and is bred from the excrements of the cows and other horned cattle. By gathering the earth, sand, and dung, from these ponds, innumerable blood worms may be found; some are also to be met with in the ditches or drains that run from houses, farm-yards, &c., but they are not so large as those found in the cowlayers. In the ditches, drains, and sewers, the curious may find so many blood-worms, that certain parts appear a mass of blood, over which innumerable gnats are playing; they are about an inch long, and not much thicker than a worsted needle, and of a blood-red colour, from which they take their name: they generally appear in April. This worm is very lively, and a most killing bait for many fish, particularly gudgeons, carp, roach, dace, &c. Put two or three on the hook together. To preserve them alive, keep them in some earth mixed with a little damp cow, horse, or pig-dung; or they may be kept in the soil you find them in when taken from the ponds.

Shrimps.—Live or dead shrimps are a good bait for perch, eels, ruffs or pope, and flounders. If dead, the shell or case must be taken off before you use them. When you use shrimps for a bait, enter the point of your hook in its side near the back, and bring it to the side of the head near the eye. During the summer months, the canal crossing the Isle of Dogs abounds with shrimps, which are easily taken with a minnow or fine landing-net. Note: When angling for perch, carp, pike, barbel, chub, roach, &c., during the months of June,

July, August, and September, you must not expect them to feed in the middle of the day, say from eleven to four o'clock in the afternoon, unless the weather is very dark and gloomy. During drizzling rain or a light breeze of wind, therefore, fish early and late, or you lose your time and labour. Many a good perch have I taken in the East India Docks with a live shrimp.

Wasp, Grubs, Maggots, Clap Baits, and Case Worms, or Cad Bait.—The young wasp or bee, when in the state of maggot, is an excellent dapping and tripping bait for trout: this maggot is much like the common gentle, but considerably larger; use a No. 8 hook, and put a good bunch of them on at a time, and let them swim down the current, touching the bottom. There are two kinds of maggots which were used by anglers formerly, but the experienced of the present day very properly reject them. These maggots, or, as some call them, bobs, and grubs, are found when turned up by the plough, particularly in the spring, and in a sandy soil; they are three times as big as a gentle, and have a red head: they are the breed of insects called cockchaffers.

The best time to collect a stock of worms is in March or April, for at that season they are very healthy, and may be kept more than twelve months, by following the directions here given.

I would advise the angler always to take a few red worms with him when he goes to fish, even if he intends to try for roach or any other fish; for, although paste is the proper bait for roach, yet sometimes a perch will make his appearance among the roach, which he may have collected about his baited hook, and his sport will instantly cease: in that case a worm bait is the best remedy; for, on applying it, the disturber is generally soon taken.

Chicken's Guts, or any kind of poultry, form, when fresh, excellent bait for eels, and occasionally for jack and pike.

Paste.—Paste is a killing bait for almost every kind of fish that breed in rivers or any fresh waters, but it requires some little time and labour to make it, which must be done with clean hands; also care and skill in using it. Many strange and ridiculous receipts are to be met with for making paste, which tend much to con-

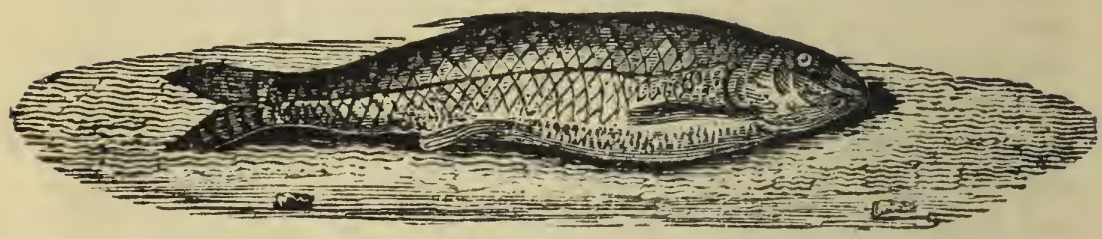
found and puzzle the inexperienced angler; such as part of the leg of a kitten, with bee's wax, suet, &c. beat in a mortar; or, cherries and cheese, sheep's blood and saffron; or, cheese, flour, dead men's fat, aniseed water and roasted bacon: many others, equally useless and absurd, I could mention; but I shall better serve the novice in angling by assuring him that nothing more is wanted in making paste to kill every kind of fish which will take paste, than flour, bread, water, and honey (with a little vermillion or red ochre to colour the paste, which may sometimes be useful), and teaching him how to make and use the same.

Sweet Paste for Carp, Tench, Chub, and Roach.—Take the crumb of a penny roll, or a piece of loaf the same size, of the first day's baking, and dip it into honey; then work it in your hands, that the honey may be well incorporated with the bread, and until it is of a sufficient consistence to remain on the hook: this is the most killing bait for carp I ever met with, during the months of July and August, and the rest of the season. Tench are also very fond of it; likewise chub and roach. I have taken many heavy roach with this sweet paste when they refused every other bait. The quantity I have named is enough for a day's fishing, but it is proper to take some to throw in occasionally close to your float, while angling. When honey is not to be had, dissolve a quantity of loaf sugar in warm water, and dip the bread therein; this makes a good, clean, and sweet paste when well kneaded.

Plain Paste for Roach, &c.—Take a piece of the crumb of a roll or loaf the day after it is baked, about the size of an apple, and dip it lightly in water; immediately squeeze it as dry as possible, and then place it in your left hand, and with your right thumb and fingers work or knead it well until it becomes exceedingly smooth and stiff. To make this paste to the consistence I have named, it will require to be kneaded a quarter of an hour at least. This paste, when well made, is the best bait used for roach, as they will seldom refuse it at any time of the year. Carp, tench, chub, dace, bleak, barbel, and minnows, will also take it.—This paste is valuable from its being easily made while you are at the water-side; indeed it is most proper to make it there, espe-

cially if you fish at any distance from home, as it may chance to get somewhat sour by carrying it a length of time; it is further valuable in striking fish when they bite; for, if made properly, it will adhere to the hook until you have struck; it then flies all to pieces, consequently your hook is not impeded in fixing in the fish, which is material, particularly in angling for roach.

In making paste it is absolutely necessary that your hands should be very clean, and likewise the bread and water, otherwise the paste will be of a bad colour and taste. In that case you must not expect success.



THE GUDGEON.

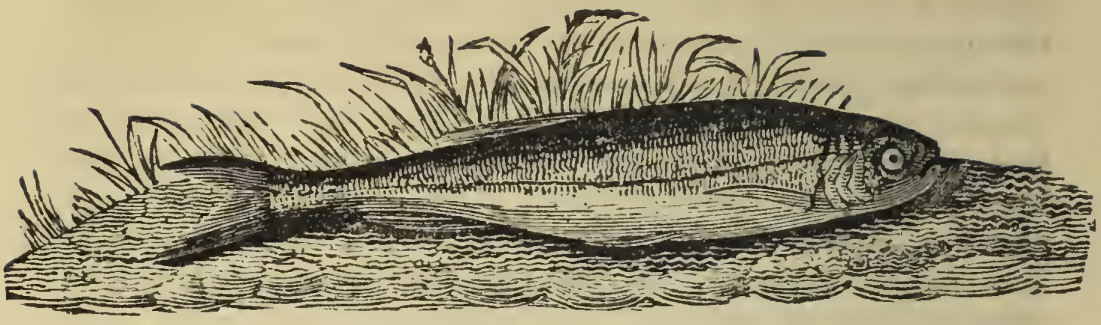
The Gudgeon is to be found in most of the English rivers: it delights most in gentle streams, with gravelly and sandy bottoms. Mr. Pennant records one caught near Uxbridge that weighed half a pound. I know a gentleman who was fishing for perch with a red-worm, at Reading, July, 1833, who caught a gudgeon that weighed a pound. Though properly a river fish, they thrive amazingly in ponds which have gravelly scours, and are fed with brooks running through them. The shape of the body is thick and round; they have no scales, and are somewhat of a smelt-like appearance. This fish is leather-mouthed; the lower jaw is shorter than the upper: at each corner of the mouth is a single beard; the back is a dark olive, streaked with black; the lateral line straight, the sides beneath that silvery; the belly white; the tail is forked, and, as well as the dorsal fin, is beautifully marked with black. The flesh of the Gudgeon is so delicious, as to be called the fresh-water smelt.

The gudgeon bites freely, from the latter end of

spring until autumn commences, in gloomy warm days, from an hour after sunrise to within the same space of its setting; during the rest of the year, in the middle of the day, when it is warmest; for they do not take readily in cold weather, nor soon after spawning. In angling for this fish in the shallows, the tackle must be very fine; a single hair or fine gut line, a hook No. 8 or 9, a short rod and line, and a small porcupine float; the bait should drag on the ground. They will take the small red-worm, gentles, and blood-worms; the first is perhaps the best, and a rake (or the boat-hook, if fishing from a boat) should be kept frequently stirring the bottom. To this spot they assemble in shoals, expecting food from the discolouring of the water; and by now and then throwing in a handful of gravel, mixed with dead gentles, they are also kept together, and sometimes great quantities are then taken. They are apt to nibble at the bait; the angler ought not, therefore, to strike at the first biting. Some use two or three hooks on the line, which is a bad practice; one hook is always preferable—more are likely to entangle, and make clumsy fishing.

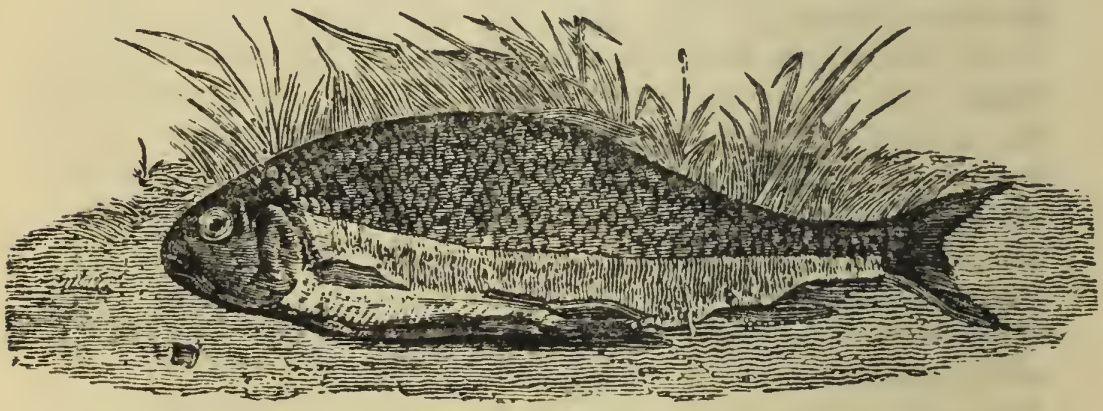
Should a London Angler desire a good day's fishing for Gudgeon, and a pleasant walk into the bargain, let him trudge as far as Hornsey-Wood House, then take the first turning to the right by the side of the house, which leads into the high-road, to reach which the passenger has to cross the New River. At this bridge he will find a snug and retired spot for his pastime. The angler must provide himself with a rake, and throw a few dead gentles, with some small gravel, repeatedly into the stream. Let him fish on the bottom, and he may make sure of good sport, not only of Gudgeon, but many Roach and Dace.—A walking-stick rod will do, and also assist him on the road.

Or should he be disposed for a longer journey, let him start at once for the Castle, at Hampton Bridge. It is an excellent spot for Gudgeon. The good landlord will furnish him with a rake, and he may then have sport till he is tired of it. Let me advise him to fish in the stream that supplies the mill, where the waters meet. He will there find the fish on the watch for food.



THE BLEAK.

BLEAK are handsome fish, but do not grow to a large size, seldom exceeding two ounces in weight, and not much valued for their flavour: they are a lively sportive fish, and easily taken with a gentle, or with a small fly at the top of the water, and paste or gentles at mid-water, but seldom at the bottom. Fish with a single hair line on a light cane rod, No. 12 hook, no shots nor float; then with a quick eye you will have plenty of sport, throwing in now and then some fine gravel. Bleak will bite all day from April till October, affording the young angler sport and practice; they may be caught in all parts of the New River, from Sadler's Wells to Ware. Strike the moment you perceive a bite.



THE ROACH.

ROACH is a handsome fish, either in or fresh out of the water; it inhabits many of our deep still rivers, delighting most in quiet waters. It is gregarious, keeping in large shoals. It has a small head, a leathery mouth, which is round, and also small, with the teeth

in the throat; large eyes, the circle of which resembles gold colour, and the iris red, particularly whilst in perfection, as they may also be known to be by the smoothness of the scales, which, when out of season, feel like the rough side of an oyster-shell; the side line bends much on the middle, towards the belly, and the tail is a little forked. It is so silly a fish that it has acquired the name of the water sheep, in contra-distinction to the carp, who for his subtlety is termed the water fox. The proverb of 'sound as a roach,' appears to be not peculiar to this country; the French have the same idea, who compare people of strong health to their *gardon*, our roach, and yet this fish is not more distinguished for its vivacity than many others.

There is a kind of roach in some ponds and standing waters that is very flat, having whitish eyes and fins, and the tail much forked; it is supposed to be bred from the bream and roach; they never grow large, and are good for nothing. Roach differ much in goodness, according to the rivers they are taken from, but none of the species are good in ponds; in many of the streams they are taken of two pounds' weight, but the preferable size for eating, are those of about half a pound, and probably, were they not so common and numerous, would not be so much despised as they are now. Soup made of this fish is excellent.

Walton speaks of the largest roach in the kingdom being in the Thames, where many have been caught of the weight of two pounds and a half; and, in a list published some years ago, mention is made of one which weighed five pounds, but the best roach I have taken were in the East-India Docks, for which permission must be got.

The roach delights in gravelly, sandy, or a kind of slimy marl bottom, under a deep, gentle, running stream: in summer they often frequent shallows near the tails of fords, lie under banks among weeds (especially when the water is thick), under the shade of boughs; and at or opposite the mouth of a rivulet, or brook that empties itself into a large river, the best roach are generally to be met with; as winter approaches, their haunt is changed to clear, deep, and still waters.

The roach spawns the latter end of May: for three weeks after spawning, they are unwholesome; they recover themselves in July, and get good about Michaelmas, but are in their prime in February or March.

Many ways are recommended to catch this fish by angling. When in deep waters, near piles of bridges, flood-gates, &c., in hot weather, a May or ant-fly is to be sunk by a little lead, within a few inches of the hook, near the sides of these posts or piles; this is to be pulled up very leisurely, a roach will generally attend the fly to the surface, there gaze on it for a moment, and then take it.

To London Bridge, and among the shipping below it, numbers of roach return in June and July, after having been up the river to spawn, and many of them are taken by means of a strong cord, to which is fastened a leaden weight, more or less, according to the strength of the current; a foot above the lead, a twine twelve feet long is joined to the cord, and to this twine, at convenient distances, are tied a dozen hair links, with roach hooks at their ends; these are baited with white snails or periwinkles, taken whole from the shell; the twine with the hooks is then first thrown in, that the stream may run it out its full length without entangling, the weight is then let down to the bottom, the fisherman holds the cord in his hand, and readily feels the biting of the fish, which is a signal to pull up the weight and line: frequently five or six, and seldom less than two or three, are taken at a haul, and they are, for the most part, very large: by standing in a lighter or lug boat, that is fastened to some vessel, this method can be best managed—but this is poaching, not angling.

In fishing for roach in ponds, chew and throw in white bread, baiting with one large gentle, and fish six inches from the bottom: others, for winter fishing, when maggots (which are, beyond question, the best winter bait) are not to be had, use greaves from the tallow-chandlers, thus prepared: put them in cold water upon the fire, in pieces of about half a pound, let them continue until near boiling, when they will become white and soft; the whitest are to be reserved for the hook, and the rest used as ground-bait; the hook should be No. 6, and the bait either touch the bottom, or lie within

one inch of it. Earth bobs and gentles are famous winter baits, using boiled malt or fresh grains as ground-bait; in autumn, roach will take white paste, on a hook No. 8; in summer, snails and flies, under water, for they never rise at a fly like the dace. In April, cadis, oak-worms, and small red-worms, the latter especially in windy weather.

The season for roach fishing in the Thames begins about the latter end of August, and continues longer than most anglers (of which the Londoners, for roach, are perhaps the best) choose to brave the weather. In the summer they live on the weed, and do not quit for the deeps until it becomes putrid, which depends on the drought or wetness of the weather, much rain hastening its rotting; the fishermen all along the river are at this time upon the watch, and the instant the roach move, sweep them away with their drag-nets; it requires, therefore, skill in the angler to attend to this critical period, or the objects of his diversion are by wholesale carried to market.

The tackle for roach must be fine and strong; rod not exceeding six feet, a line somewhat shorter, a porcupine float, and hooks, No. 11 or 12, (although, if not made of stouter wire than those usually sold of those sizes, No. 9 or 10; roach rarely break the hook in the water, yet the beard of these very fine hooks is frequently broken at the time of being extracted by the fish's springing about, and their mouths being so bony); the baits, gentles, red paste, boiled wheat, or malt: the gentles of a pale red colour, with a white one, are often taken both by roach and dace with great eagerness; red paste is also excellent. (The angler is cautioned to be provided with several sorts of baits, as these fish are capricious in their feeding, and, in the course of a morn or eve, will shun what they had just before taken, and, in a short time, again with avidity seize that, rejecting all others). Great attention must be paid to strike quick. In using boiled malt or wheat, select those corns that are soft and plump; one is sufficient: put the hook into it so that the point may lie where it is burst and the white appears; the fish will be more readily hooked. The ground-bait should be boiled malt, with which some holes may be previously baited; if that mode is

not adopted, whilst fishing throw it in, from time to time, sparingly, or some bran mixed with clay, and put a few dead gentles with it; throw it a little above your swim; let the ground-bait be made up into small balls.

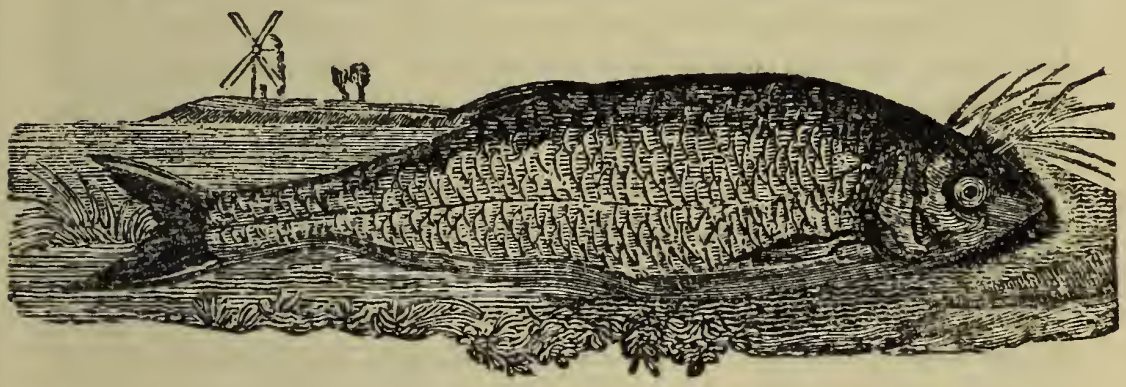
The following method is mentioned as being more generally successful than any other. A rod, rather stiff, which will strike true, and in length proportioned to the place where used; the line, a foot shorter than the rod, strong at top and tapering to the bottom, which must be fine, smooth, silk-worm gut, dyed brownish, or of a water colour; the hook No. 8; one small shot is to be put on the line about six inches from the hook, the rest close together, four or five inches higher up, sufficient to sink a swan-quill or porcupine float so that its top may just be discerned above the surface. When a spot is fixed on, plumb the depth, and the float is to carry the bait not more than one inch from the bottom, which must be level, the run gentle, and the water deep when clear, or in winter; at other times, when the water is coloured with rain, and especially if in the rain, the bait should swim from about three quarters of a yard to the depth of a yard and a half: if in a tide, or where streams rise or fall, the depth, by means of the plummet, is to be ascertained and observed as above directed.

The bait is a grain or two of salmon's roe, or a small piece of red paste in imitation of it (which is as good as the roe, and will continue on the hook a long time, if properly made, even if the fish is struck at and missed, and there be no cotton mixed with it). A sharp eye must be kept on the float, and the least nibble is the signal for striking; if a full-sized roach is hooked, he should be played, for they struggle much; and, although many accustom themselves to a single hair line, yet, where the fish run large, it is not always to be depended upon. A landing-net is useful in getting out the big ones, and by drawing them two or three yards below where the ground-bait lies there will be less disturbance to the fish beneath.

Roach are also to be caught in warm weather with cadis and natural flies under water; and they will sometimes, in warm close evenings, a little before sunset, take an artificial fly at top, but then a well-scoured

gentle must be placed at the end of the fly. In mild cloudy weather, the roach will bite all day; in hot, morning and evening; and in cold, the middle and warmest parts of it.

In roach fishing great care should be taken in kneading up your pastes, that your hands be perfectly clean; for should you discolour your bait, you will have no sport.



THE DACE.

Dace, or Dare, is gregarious, is a great breeder, very lively, and during summer is fond of playing near the surface. Its head is small, the irides of a pale yellow, the body long and slender; its scales are smaller than those of the roach, and it is upon the whole a handsomer fish: the back is varied with dusky, and a cast of yellowish green; the sides and belly silvery; the ventral, anal, and caudal fins are sometimes of a pale red hue; the tail is very much forked. The dace is seldom above ten inches long; although in a list of fish sold in the London markets, with the greatest weight of each, communicated to Mr. Pennant, there is an account of one that weighed a pound and a half; and, according to Linnæus, it grows to a foot and a half in length.

The haunts of dace are deep water near piles of bridges, where the stream is gentle, over gravelly, sandy, and clayey bottoms; deep holes that are shaded, water lily leaves, and under the foam caused by an eddy; in the warm months they are to be found in shoals on the shallows near to streams. Dace spawn in March, and are in season about three weeks after;

they improve and are good about Michaelmas, but are best in February.

This is a fish affording great sport to the angler; indeed, more pleasure than profit, for the flesh is insipid, and full of bones. The baits for dace are the red-worm, brandling, gilt-tail, cow-dung and earth-bob, and indeed any worm bred on trees or bushes, that is not too big for his mouth, and almost every kind of fly and caterpillar. Flesh flies upon the surface, with the hook put into the back between the wings; the line from the middle downwards of single hairs, and a trifle longer than the rod, which ought to be eighteen feet at least, and as light as possible; the flies can be kept in a vial; fix three very small hooks upon single hair links, not above four inches long to the line, and in a summer's evening, at the smoothest part of the end of a mill-stream, from seven or eight, and so long as light continues, the dace will yield diversion. In the same manner, they will rise in the morning at the ant-fly, if used at the foot of a current or mill-stream, or on a scour before the sun comes on the water.

After rains, when the river is nearly level with its banks, use the caterpillar fly or a small red palmer and a yellow gentle (the yellower the better); run the hook through its skin, and draw it up to the tail of the fly, then whip on the surface, and the dace will rise freely.

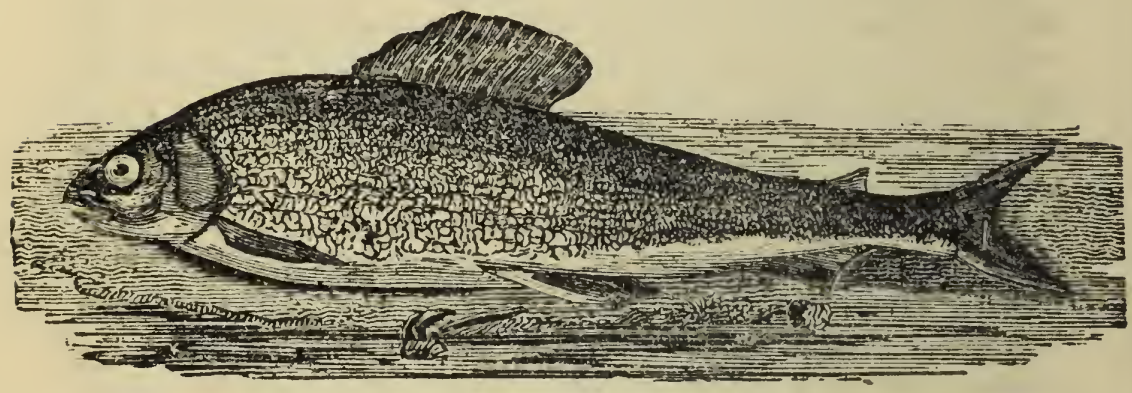
Another way to take this fish from the middle of April until the beginning of October, is by artificial fly-fishing with a long line, the fly generally either black, brown, or red, made very small, on a hook No. 8 or 9. The three may be on the line together, about a yard asunder, letting the black one be the lower fly, and that alone have a gentle at the end of it, and the other two to be the drop flies; by this mode many dozens may be taken in the course of a morning or afternoon; when they are on the fords, and the weather is favourable, particularly in rivers where the tide flows a moderate height, (as for instance, in the Thames, between Kew and Richmond bridges) for every tide is a kind of fresh water to the fish, and, as it clears off, they will take astonishingly. The chief biting times are, hot weather, early or late; in cold, the middle; and in mild cloudy weather, the whole of the day; but after a hot, bright

sun, they will take the above flies in the clearest water, from a little before sunset until dark. Above Richmond, when the weeds begin to rot, a grasshopper with the first joint of his legs pinched off, and the hook put in at the head and brought out at the tail, and used as an artificial fly, does great execution in a warm day upon the shallows; this fishing can only be done in a boat, which is to drive down with the current (having a heavy stone, by way of anchor, fastened to a rope five or six yards long, at the head of the punt or wherry): when come to a likely spot, drop the stone, and standing in the stern, throw right down the stream, and then to the right and left; after trying about a quarter-of-an-hour in a place, weigh anchor, and proceed in the same manner at the next probable haunt; use a common fly-line, about ten yards long, and a strong single hair next the hook. It may be said there is less certainty of catching dace in this way, than with a float and ground-bait; but to those who are situated near the banks of the Thames, between Windsor and Isleworth, so as to take advantage of a still, warm, gloomy day, it will afford much more amusement than the ordinary method.

In angling for dace with maggots, the tackle cannot be too fine, the float small, the hook No. 9, the shot a foot from it: by baiting the place with a few maggots before fishing, the diversion will be increased. If using gentles in an eddy between two mill-streams, and the water is only two or three feet deep, there will be greater chance of success than where it is deeper; use here a cork float, bait with three large gentles, and strike at the first nibble; if there are large dace in the mill-pool, they will resort to this eddy.

In bottom fishing for dace, let the ground-bait be bread, soaked an hour in water; put an equal quantity of bran, knead it to a tough consistence, and make it into balls, with a small pebble in the middle to sink them; throw these balls a little up the stream from the spot where it is proposed to angle, that the current may not drive them beyond the reach of the line. Fish for dace within three inches of the ground, especially where the ant-fly is the bait under water. The compiler has caught dace of upwards of a pound weight, upon night-lines, baited with minnow for eels.

In the Mersey, near Warrington, a fish called the Graining is taken, which much resembles the dace, but is slenderer, and the back straighter; the usual length does not exceed eight inches. The colour of the back is silvery, with a blueish cast; the eyes, ventral and anal fins, are paler than those of the dace; but the pectoral fin is redder, and they are much better eating.



THE GRAYLING.

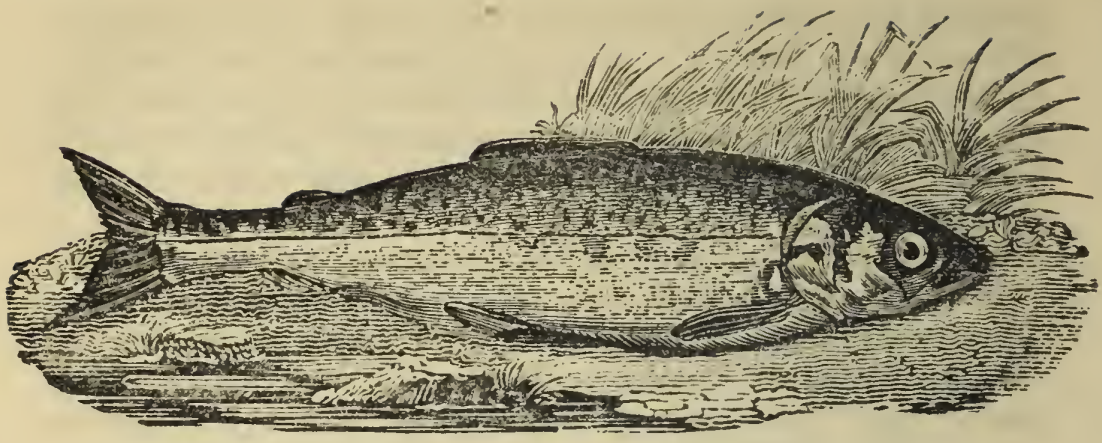
The haunts of the grayling are in rapid and clear streams, particularly such as flow through mountainous countries. They are to be found in those of Yorkshire, Shropshire, and Salisbury, in Italy and Switzerland, and in most trout streams. They are usually taken with the same baits and after the same manner as the trout. The grayling is a fish of elegant form; the body is not so deep as that of the trout; the head small, with protuberant eyes, the irides silvery and speckled with yellow; the mouth of middle size, and the upper jaw the largest. The teeth are very minute, seated in the jaws and roof of the mouth, and feel like a fine file; the head is dusky, the covers of the gills glossy green, but when in prime perfection these parts are blackish. The back is of a dusky green, inclining to blue; the sides of a fine silvery gray (from which the fish derives its name), marked with black spots, irregularly placed; and when first taken, it seems to glitter with spangles of gold. The side line is nearly straight, the scales are large, and the lower edges are dusky; the large dorsal fin is

spotted, the other fins being quite plain. The grayling is rather hogbacked, and from the nose and belly touching the ground together, is supposed to feed mostly at the bottom. In length it seldom exceeds sixteen inches, but one was caught near Shrewsbury that weighed five pounds.

Graylings are in season from September till January, and cannot be dressed too soon after they are caught. They lurk close all the winter, and begin to be active and to spawn in April or early in May; at which time, and during the summer, they are to be taken near the sides and at the tails of sharp streams, with any of the trout flies. They rise more boldly than the trout, and if missed several times, will still pursue the bait. I have known them to rise upwards of twenty times at the fly, yet, notwithstanding they are so sportive after the fly, they are an inanimate fish when hooked, and the sides of the mouth are so tender that, unless great care be taken, the hold will be frequently broken and you lose your fish. In September they retire in shoals to the lower ends of still holes, just where the water becomes shallow, where they will take the fly at the top, which should be small: the camlet-fly is the best, and the hook No. 7 or 8.

When the water is not proper for flies, and you wish to angle for the grayling below the surface, use gentles, (which they will eagerly bite at) wasp-grubs, or scoured worms, as near the ground as possible. The cad-bait and other small insects, which hide themselves in husks, they will greedily feed on; and they have often been observed rooting up the gravel and catching at every thing of the kind.

Walton says that the grayling will take a minnow, and his authority is not to be lightly questioned; but anglers of great experience have never found this bait successful. Graylings will bite during the whole of cool and cloudy days, but the preferable times in spring and summer are from eight in the morning until twelve, and from four in the afternoon until after sunset; from September to January, in the middle of the day.



THE SAMLET, OR SKEDGER TROUT.

THE general shape of trouts is rather long than broad: in several of the Scotch and Irish lakes and rivers, they grow so much thicker than those of England, that a fish from eighteen to twenty-two inches will often weigh from three to five pounds. The trout is a fish of prey, has a short roundish head, blunt nose, wide mouth, and filled with teeth, not only in the jaws, but on the palate and tongue: the scales are small, their back is ash-colour, the sides yellow, and when in season, the body and covers of the gills are sprinkled all over with small beautiful red and black spots; the tail is broad.

There are several sorts of trout, differing in their size. In many of the smaller streams there are trouts that always continue small, but are very great breeders: these are Samlet or Skedger Trout, as seen in the engraving above. I know a little brook in Kent that breeds them to a great number, and you may take them twenty or forty in an hour, but none larger than about the common size of a gudgeon: many have I taken at Winchester, on the bridge, or in the Thames about Windsor, in which places I have caught ten or twenty at a standing. They also are to be found in divers rivers near the sea. They bite as freely and as fast as minnows.

In some rivers, trouts begin to spawn in October, but November is the chief month; at the end of September they quit the deep water to which they had retired, during the latter part of the hot weather, and make great efforts to gain the source of the currents (they also

swim up brooks, where they are too often destroyed by the poacher, who is always upon the watch, and is sure to cause terrible havoc at this season) seeking out proper places for spawning: this is always upon a gravelly bottom, or where gravel and sand are mixed among stones, towards the end and sides of a stream, and in lakes, &c., where the bottoms are gravel; among weeds, where they make themselves beds and deposit their ova; (they are very prolific, and the spawn is most eagerly sought after and devoured by the grayling); at which period they turn black about the head and body, and become soft and unwholesome; in fact, they are never good when big with roe, which is contrary to the nature of most other fish. After spawning, they become feeble, their bodies wasted, and those beautiful spots which before adorned them are imperceptible; their heads appear swelled, and the eyes dull, (and Mr. Pennant says, the under jaw is subject, at certain times, to the same curvature as that of the salmon). In this state they seek still waters, and continue there sick, it is supposed, all the winter; a prey also to vermin, which breeds upon and keeps them poor. These vermin are called *sugs* or *trout-lice*, a kind of worm in shape like a clove or pin with a big head, which sticks close to the trout, and sucks his moisture. I am of opinion the trout breeds them himself, and he never thrives till he frees himself from them, which is when warm weather comes; and then, as he grows stronger, he will leave the dead still water for the sharp streams and gravel, and rub off the worms; and as he grows stronger still, so will he get into swifter and swifter streams, until he fixes upon his summer residence, for which he generally chooses an eddy, behind a stone, a log, or bank that projects forward into the water, and against which the current drives; whirlpools and holes into which sharps and shallows fall, under roots of trees, and in places shaded by boughs and bushes. In small rivers trout frequently lie under sedges and weeds, especially in the beginning of the year, before their perfect strength is recovered: but when in their prime, they feed in the swiftest streams, and are often found at the upper end of mill-pools, at locks, flood-gates, and weirs, also under bridges, or between two streams, where the water seems

to boil; in the decline of summer, they lie at mill-tails, or the ends of other streams, and in the deep water.

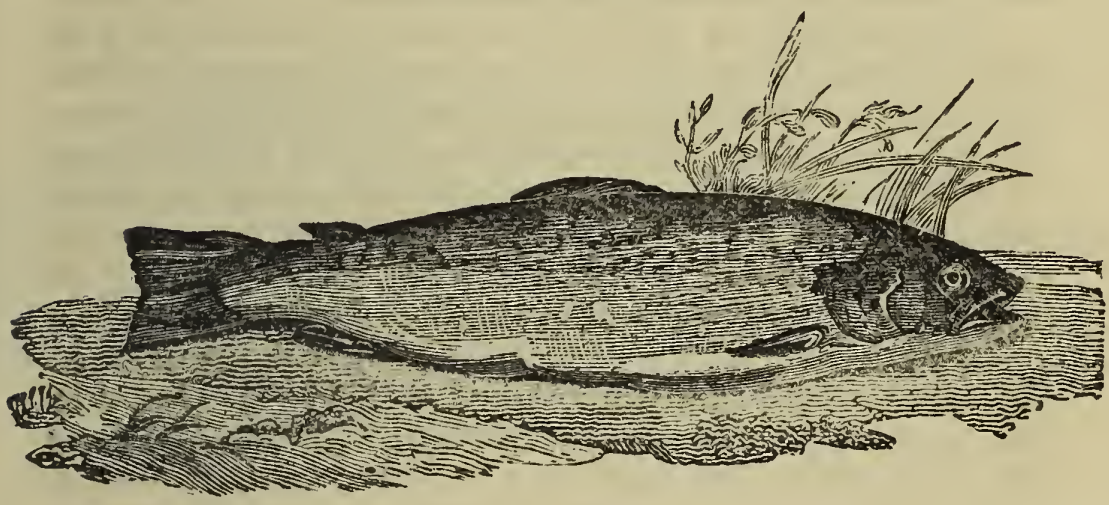
Trout may be said to be in season from March to September; they are fattest from the middle of August until the latter month, from their having fed upon the spawn and young fry of various fish: which constitutes their firmness and flavour. Some however contend, that their prime season is in May; but in that month and in June they so glut themselves with flies, as to cause a flabbiness which they neither have at the end of April nor at the time above mentioned.

There are few fish that afford the angler such diversion, or require more skill to take them, than the trout: (such is the passion to fish for them, that the liberty of angling in some of the streams in the adjacent counties is purchased at the rate of ten pounds per annum by the amateurs of the metropolis); they are at all times exceedingly circumspect, and it will be in vain to angle when the water is low by being kept up at the mills, as they then retire under the banks and roots, refusing all baits. In a cloudy day, after a gentle shower, when the mills are going, they will freely take minnows, worms, and flies of all kinds in their proper season: in March or April, angle for them with a worm in the forenoon, and with a fly or minnow, according to the state of the water, the rest of the day; in the swiftest and sharpest currents, provided the day be warm and bright, and in the deeps early and late; but if the water be discoloured or very thick, try the gravelly shallows, near the sides and tails of streams, with a worm only, to run on the bottom with one large shot a foot at least from it. When there is a small fresh, or the water is clearing off, and is of a dark brownish colour, first use the worm, (which should be a well-scoured brandling, cast in as a fly at the head of the stream, and moved gently towards you, still letting it go down with the current, so as to keep it a little under water; the line should be rather short, with no lead upon it, and the hook fine); then the minnow, and, as the water clears, the artificial flies.

When the water is clear and low in sultry weather, the beetles, blue-bottle, palmer, cad bait, wood-fly, earth-bog, minnow &c., may be successfully used.

The rod for general trout-fishing should be from four-

teen to sixteen feet, the lower part of well-seasoned ash or hazel, large enough to be so bored as to hold a stiffer top for minnow and worm angling, and towards the but-end for the reel to fasten on properly; the middle should be good yew or hickory, the top of the same nicely spliced, and about half a foot of round tortoise-shell properly lessened to the end, and the rod neatly ringed in the same manner as that for salmon; it must be regularly taper from bottom to top, with a good spring, and pliable almost to the hand for fly-fishing.



THE TROUT.

Trout are usually taken with a worm or a minnow, or with a fly, either natural or artificial. Of the worms there are many sorts—the earth-worm, the dug-worm, &c. but the dew-worm or lob-worm and the large brandling are the chief; the lob-worm for the large trout and the brandling for the lesser. There is also a species of lob-worm, some call the squirrel-tails, a worm that has a red head, a streak down the back, and a broad tail, which are noted to be the best, because they are the toughest, most lively, and live longest in the water; for, as my readers doubtlessly know, a dead worm is but a sorry bait compared to a lively, quick-stirring one. There are many other kinds of worms, such as the marsh-worm, tag-fair, flag-worm, dock-worm, &c., but whatever worms you use let them be well scoured (i. e.) kept long, previous to using. You may cleanse

or scour them quickly by placing them all night in water, if they be lob-worms, then put them into your bag with fennel, but do not put your brandling above one hour in the water. If you have time, and wish to keep them long, they will be best preserved in an earthen jar, with a good quantity of moss, which must be replenished afresh every three days in summer time, and in winter eight days, or the moss taken from them and clean washed and wrung dry between your hands.

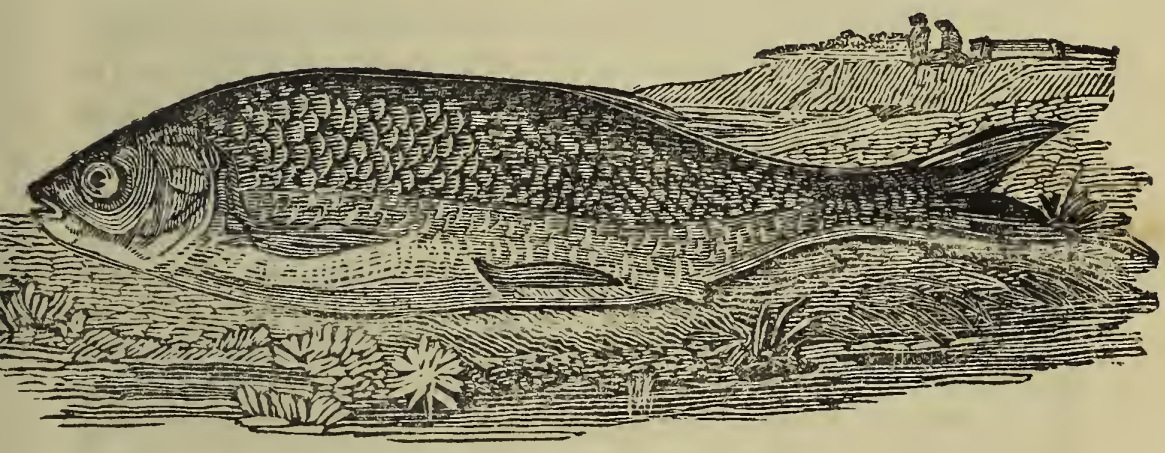
If the brandlings should be sick or flabby, to recover them put a little milk or cream by drops on the moss, about a tea-spoonful a day, and they will then soon again resume their original appearance.

Trout fishing is practised at night as well as day; and the night is the best, for trouts will then more freely leave their holes to feed. The manner of taking them is on the top of the water, with a great lob or garden worm, or rather say two, which you must fish with in a place where the waters run somewhat quietly; for in a stream, the bait will not be so well discerned. If you can place yourself in a quiet or dead place over a hole, near to some swift current, draw your bait over the top of the water to and fro, and if there be a good trout in the hole he will be sure to take it, especially if the night be dark; for then he is boldest, and lies near the top of the water on the feed, watching the motion of any frog, mouse, or water-rat, that may swim between him and the sky; for these he will hunt after. If the angler should see the water but wrinkle or move in one of these dead holes, where the greatest trouts usually lie near to their holds, he must be on the alert; for you must note, that the large trout is both subtle and fearful. He lies in his hole as close in the day as the timorous hare does in her form. The chief feeding is seldom in the day, but usually at night, and the large trout feed boldly.

You must have a strong line, and not a small hook. Let the fish have time to gorge your bait, for he will not forsake it as he would in day-fishing; and should the night not be dark, fish, as above, with an artificial fly of a light colour, and at the snap. I have known them to follow a dead mouse, or a piece of cloth, or any thing that may swim across the water, and snap at it.

This plan is often adopted, but affords no pleasure to a true angler.

In Hampshire there are some very fine trout streams; indeed, I do not know its equal for swift, shallow, clear, and pleasant brooks, with stores of trout. The people of the county catch trout in the night, aided by the light of a torch made of straw. When they discover one, they strike him with a trout spear, &c., and a great many they catch in this way; but I do not like it.



THE CHUB.

This fish takes its name from the head, not only in our own, but other languages; he much resembles the carp, but is of a longer form; the body is oblong, rather round, and of a pretty equal thickness in the greater part of the slope; the scales are large, the irides silvery; the cheeks of the same colour; the head and back of a deep dusky green; the sides silvery, but in the summer yellow; the belly white; the pectoral fins of a pale yellow; the ventral and anal fins, red; the tail forked, of a brownish hue, but tinged with blue at the end; he is altogether a handsome fish, and will sometimes weigh upwards of five pounds. The flesh of the chub is not in much esteem, and when out of season full of small hairy bones; but the roe is exceedingly good, and this fish, stewed as carp, will, it is said, deceive an epicure.

The haunts of the chub are in rivers whose bottoms are of sand or clay, or which flow over a rocky bottom,

in deep holes, under hollow banks, in summer particularly, where, shaded by trees, weeds, &c., they frequently float on the surface, and are sometimes found in streams and deep waters where the currents are strong: in ponds, fed by a rivulet, they grow to a large size.

The chub does not afford the angler so much diversion as the trout, from being so dull a fish on the hook, and when once struck becoming soon tired; but he bites so eagerly, that when he takes the bait, his jaws are heard to chop like those of the dog, and having a very wide leather mouth, and his teeth in his throat, there is little danger of his breaking his hold. To fish for him, the angler should have a stout long rod, a strong line (if he uses a reel, he will be enabled the better to fish under bushes) with a yard or more of the best silk-worm gut at bottom, a hook proportioned to the bait used, a swan-quill float, and the line so shotted, eight or ten inches from the hook, as to sink the float to a quarter-of-an-inch above the surface; the same ground-bait is to be used as for the carp, and the hook baited with a sufficient quantity of salmon's roe (boiled a little) to fill the bend properly; this, rightly managed, is a tempting bait. The large ones are to be caught by dibbing, very early in a morning, with the brown beetle, or cockchafer: by day-break the angler should be at the river; and after baiting his hook, let him move it two or three times near the surface, as in the act of flying; then let it drop on the water, shaking the rod gently, which will cause the appearance of its struggling to escape; this attracts the chub, who are so fond of this bait, that they will rise two or three at a time to seize it; the landing-net in this fishing should never be forgotten, as the places most likely for success in taking the chub are those where the angler cannot get to the water side to land them with his hands.

The chub will take a grub, gentles that are green, wasps' maggots (which must be baked in an oven before used), paste of fine new white bread (without being made wet), worked up in the hand, and tinged with vermilion as near as possible to the colour of salmon's roe: this paste will not easily wash off from the hook, and is a most killing bait; but the best baits for *bottom* or *float* fishing for the chub, are old Cheshire cheese,

worked with the crumb of a new roll (such as without crumbling will mould in the hand), or the pith from the back-bone of an ox, with the outward skin so carefully taken off as not to bruise the inward one. At every season of the year the former of these is good; but the latter end of summer, and all the winter, are the preferable times for both. In baiting with the cheese, put a round lump, the size of a cherry, on a large hook, so as to cover the bend and some way up the shank: fish six inches from the bottom, or in cold raw weather the bait may lie on the ground; but if the hole has not been ground-baited, the depth is immaterial. When there is a bite, the float will be drawn under water; strike immediately, and give him play, holding a tolerably tight line, to keep the fish clear from weeds and stumps, which at sight of the angler he will endeavour to get at for shelter; and if not properly managed, he will break the tackle. In the spring of the year, the chub will take a marsh, or small red worm; in May, June, and July, flies, beetles, snails (the black ones with the belly slit, to show the white); in August, pastes. The large chub will also take minnows, small dace, and gudgeons, angled with in the same manner as for perch; and the latter bait used likewise as in trolling for pike, the hook not so heavy leaded upon the shank; they gorge immediately upon taking the bait: their biting times are chiefly from before sunrise until nine in the morning, and from four until after sunset in the summer, (some will by chance take at any time of the day, when mild and cloudy); and in winter the middle of the day is best; remembering that in hot weather they are to be fished for at or near the top, and not deeper than mid-water; and in cold, close to, or upon the bottom; and that the main point in taking this fish is for the angler to keep himself out of sight.

THE CARP.

Carp are esteemed among the richest fresh water fish we have in the kingdom: they are the principal stock of park canals and manor ponds, to the owners of which they afford considerable profit; particularly near populous cities, where they can be disposed of to advantage at the season when such ponds are drawn, and new stocked with stores. Much success depends upon the nature of the soil where the pond is situate: if in a soft marley kind of earth, or warm clay, impregnated with hazel earth, and a muddy bottom, they thrive beyond calculation; but, upon a dead, black, moory gravel, or a flinty, chalky bottom, they are steril beyond description, in both growth and propagation. They are a fish so exceedingly shy, or so cunning, (especially river carp) that they afford very little success to the angler, who ought to be one of the most patient adventurers that ever embarked in aquatic sporting. They are but little found in running streams or rivers, notwithstanding very large quantities of small store are constantly thrown in from the reservoirs and breeding ponds of gentlemen living in the vicinity of such rivers, not more to get rid of their own superflux, than to promote a friendly supply for the accommodation of their neighbours.

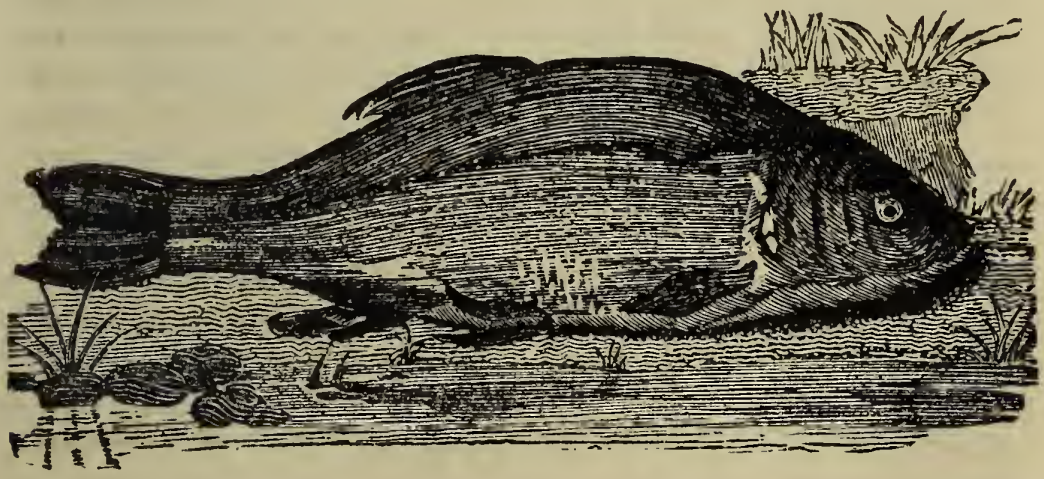
Angling for carp must be pursued either early or late in the day, and in hot weather, for he will not bite in cold.

The bait may be either worms or paste—of worms, the bluish marsh or meadow is best, but a red worm, not too big, will do, or a green gentle; of pastes, the

best one is made of bread and honey or sugar, for it is with sweets the angler will easier beguile this crafty fish, and should be thrown into the pond or stream some hours before you commence fishing, to draw them to the spot selected for angling. In a large pond, to draw them together, throw in either grains, or blood mixed with cowdung, or bran, or garbage, as chicken-guts; follow this with some of the small sweet balls you intend angling with; but be careful not to give them too freely.

To make the paste stick to your hook, add a little fine wool; work that and the paste together with your hands, not too hard, but just sufficiently to make it tough enough to hang upon your hook. Your hands must be perfectly clean. Either white or yellowish wool will do.

If you fish for a carp with gentles, put on your hook a small piece of scarlet cloth, about this bigness , soaked with oil of peter, by some called oil of the rock, and keep your gentles for two or three days in a box anointed with honey; and while you are fishing, chew a little bread, and throw in about the place where your float swims. In this way, with due patience, you may prove a match for this crafty fish. There are many other baits, but this you will find far the most killing, though the crumb of white bait and honey made into paste is excellent.



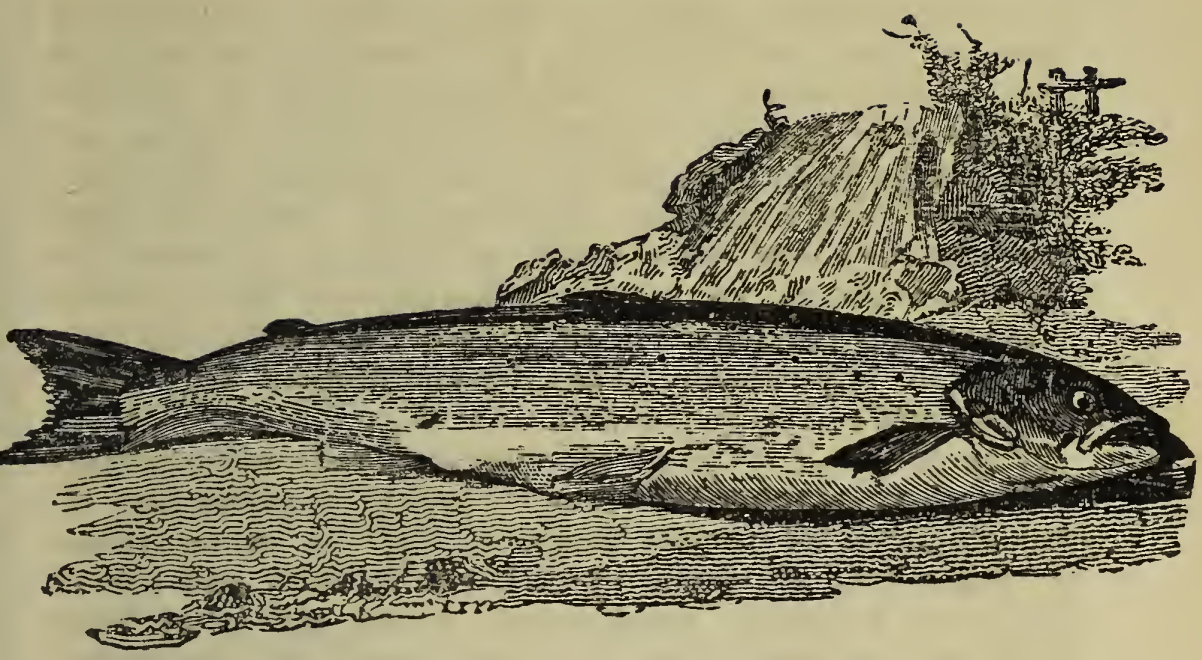
THE TENCH.

THE Tench is called the physician of the fishes, of the pike or jack especially, for it is generally believed

(and we think justly), that the pike, when hurt or sick, is cured by the touch of the tench; certain it is that the pike will not devour him, though ever so ravenously hungry. However, without vouching for the virtue of its slime upon the inhabitants of the water, its flesh is undoubtedly a delicious and wholesome food to those of the earth. The tench does not commonly exceed four or five pounds in weight; Mr. Pennant says he has heard of one that weighed ten, and Salvianus speaks of some that weighed twenty pounds: it is thick in proportion to the length; the scales are very small, smooth, and covered with slime; the eyes are large, with a red circle round them, and of a gold colour; the irides are red; he is leather-mouthed, and there is a small barb at each corner of the mouth, and in the head there are two small stones which foreign physicians make great use of; the colour of the back is dusky, the dorsal and ventral fins of the same hue, and those of the male much bigger than those of the female; the head, sides, and belly of a greenish cast, most beautifully mixed with gold (especially those taken in rivers), which is in its greatest splendour when the fish is most in season: the tail is quite even at the end, and very broad when extended.

Tench love still foul waters, and their haunts in rivers are chiefly among weeds, and in places well shaded with bushes or rushes; but they thrive best in standing waters, where they lie under weeds, near sluices, and at pond-heads. They are much more numerous in pools and pits than in rivers, although those taken in the latter are far preferable; they begin to spawn in June, and may be found spawning in some waters till September; their best season is from that period until the end of May.

To fish for tench, make up some paste of brown bread and honey, and you may use a marsh-worm, but he will take the paste in preference, especially if you add to it a little tar. He will also take a small red-worm, the head nipped off, and a cod-worm put on the hook first; but he will only feed in the three hot months. He will likewise bite at a lob-worm, or a green gentle; but the pastes are by far the most killing baits.



THE SALMON.

The Salmon may justly be termed, among fresh-water fish, the superior of the rivers, both from its size and excellence; it is, however, so universally known, that a brief description will serve: it is handsome in its make, the head small, with a sharp pointed nose; the colour of the back and sides are gray, frequently spotted with black, sometimes plain; the covers of the gills are subject to the same variety; the belly is silvery (the female may be distinguished by having a longer snout, and the scales being more dull; the flesh is said likewise to be drier, of a paler red, to have less flavour, and ,according to Walton, she is of inferior size); the teeth are lodged in the jaws and on the tongue, are slender but very sharp; the body is longish, and the tail a little forked.

At the latter end of the year, and sometimes in November, salmon begin to press up the rivers as far as they can reach, in order to spawn: when that period approaches, and they have accommodated themselves with a fit place, nature supplies the males with a bony excrescence, growing out of the end of the lower jaw, to the length of half an inch or more; this, it is said, aids him in the removal of the gravel, but both male and female assist in forming a proper receptacle for the spawn in the sand

or gravel, about eighteen inches deep. In this the ova and milt are deposited, and carefully covered by the parent fishes, who afterwards hasten to cleanse and recover themselves; (the male loses the gristle at the jaw;) for, after spawning, they become very poor and lean, and then are called kipper. At their first entrance into the fresh water, salmon are observed to have abundance of insects adhering to them, especially above the gills: these animalculæ denote the fish to be in high season. They die and drop off soon after the salmon's leaving the sea.

The spawn lies buried until spring, and, without any other care, is nourished and brought to perfection, if not disturbed by violent floods, or by the depredations of other fish, of which the eel, roach, dace, and grayling, are dangerous neighbours. About the latter end of March the young begin to come forth, and gradually increase to four or five inches in length, when they are termed smelts or smouts; about the beginning of May, the river seems to be alive, and there is no forming an idea of the numbers without seeing them. A seasonable flood, however, hurries them to the sea, very few being left in the river; about the middle of June, the earliest of the fry commence their return from the sea into the river (at that period from twelve to sixteen inches long), and progressively augment in number and size, until about the end of July, which is at Berwick termed the height of the gilse time (the name then given to the fish of that age). Early in August, they lessen in numbers but advance in size, some being from six to as high as nine pounds' weight: this increase appears surprisingly quick, yet a gentleman of Warrington has given an instance of still more rapid growth: a kipper salmon, weighing seven pounds and three quarters, taken on the 7th of February, was marked with scissors on the back fin and tail, and turned into the river; he was again taken on the 17th of the following March, and then weighed seventeen pounds and a half. In this case, the remark of Walton seems to have been more than verified, 'that the samlet becomes a salmon in as short a time as a gosling becomes a goose.'

Salmon bite best from six until eleven in the forenoon,

and from three in the afternoon until sunset, especially when there is a moderate breeze upon the water. The chief months to angle for them are March, April, May, and June, although they will take a fly until October, but they are then out of season. They may to be fished for with lob-worms and minnows, but will take the former much more readily than the latter: a large artificial fly is the most killing bait.

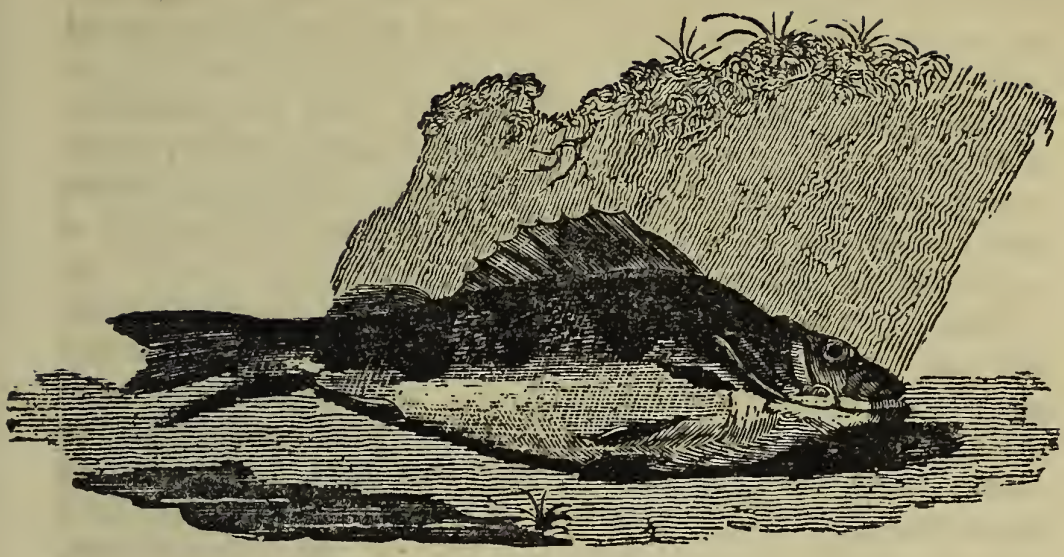
The rod should not be less than fifteen feet, or longer, according to the breadth of the river; limber, yet strong, with wire rings from the top to within three feet of where the reel is fixed, with a good running line, without knots, made of either silk or hair (the former is to be preferred), and the reel must be large enough to contain four-score yards, or at least as much as will reach more than across the river fished in. Wherever the use of the running line is directed, the reel is proper to be used; they are of various sizes, and may be proportioned to the coarseness or fineness of the line. The line from the reel, after being run through the rings, is to be joined to the foot or gut length, which must be looped at each end, the one to fasten it to the reel-line, the other to the fly; this foot-length must be made of three strong silk-worm guts twisted together; three lengths will be sufficient, as only one fly is used. The link to which the fly is fixed should be looped on the same way, for the convenience of changing it, if the fish refuse one sort of fly, and another is wished to be tried.

In trolling for salmon with minnow or grayling, the foot-length or links must be about three yards, with a swivel or two, as well to help the bait's playing freely, as to prevent the line from twisting and breaking; a large shot or two, about a foot from the bait, will keep it under water when played, and which may be either added to or diminished, according to the strength of the current. The rod must have a stiffer top than for fly-fishing; the hook large, and long in the shank, with a very small one fixed above, at nearly the distance of the length of the fish baited with. The bait is to be drawn upon the hook like a worm, by putting it into the mouth, and bending it round the curve of the hook until it comes out a little above the tail, so as to keep the tail a trifle bent. The small hook (which should be

made blunt at the point) must then be put through the lips of the fish, to prevent its slipping into the bend of the large one.

In fishing for salmon with lob-worms, the trolling-tackle is to be used, and two of these worms, well scoured, put on the hooks; the first should be drawn quite above the top of the shank of the large hook, and the small one run through its head; the second worm is to be run some way above the shank, and drawing the first down, let them hang with their tails one above the other, preventing the point of the large hook from appearing through the worm. Lay in the worms at the bottom of a stream, holding the rod still, and keeping as much as possible out of sight; if in a short time there is no bite, move the line gently up the current, and the worms will play and show themselves by means of the swivels, and thus allure the salmon to take them; if no success follows after a few trials, seek another stream, and then repeat them. This mode is to be used when either the water is too much discoloured for the artificial fly, or when the day is bright, with scarce any wind stirring, and the water so clear, that the salmon can discover the deception of it. They cannot be taken by any other method of angling than this and minnow fishing, when the weather and water are in such a state.

Another way of fishing with lob-worms for salmon, is to run the hook through the middle of a lob-worm well scoured, and pull it above the shank; then take a second, and put the hook in an inch below the tail, drawing it on the hook about three-fourths of the length, the head of the worm being at its point; then draw down the first to the latter worm: a piece of lead with a small hole through it (which is called a plumb), must be fastened upon the line, two feet above the hook; by which means the bait can be kept in any certain spot, and pulling the line tight, the plumb will be felt at the bottom, and the current will give motion to the bait with the link below it. When the bait has remained a few minutes, gently move it about a yard up the stream, and again let the plumb rest at the bottom: this will excite the attention of the fish, and frequently tempts them to seize the worms.



THE PERCH.

PERCH have one peculiarity, contrary to the nature of all other fish of prey in fresh water (and they are so voracious as to attack their own kind), that they are gregarious, swimming in shoals. The body of the perch is deep, the scales very rough, the back much arched, and the side-line approaches near to it; the irides are golden; the teeth small, disposed in the jaws and on the roof of the mouth, which is large; the edges of the covers of the gills serrated; on the lower end of the largest is a sharp spine; and the head is said to consist of no fewer than eighty bones. The colours of the perch are beautiful, the back and part of the sides being of a deep green, marked with broad black bars pointing downwards; the belly is white, tinged with red; the ventral fins are of a rich scarlet; the anal fins and tail (which is a little forked) are of the same colour, but rather paler.

This fish is a slow grower, and with us is seldom taken of an extraordinary bigness. The largest perch I ever caught weighed 3lb. 10oz.; it was taken with a roach bait, at a place near Reading, of which I shall speak anon. Where they are considered to run large, their general length is from about ten to sixteen inches.

Perch are found as well in clear, swift rivers, with pebbly gravelly bottoms, as in those of sandy and clayey soil. They are fond of water moderately deep, and

frequent holes by the sides of, or near to, gentle streams, where there is an eddy; also in the hollows under banks, among weeds and roots of trees, piles of bridges, or in ditches and the back streams, that have communication with the large river. Perch thrive well in ponds which are fed by a brook or rivulet; their haunts there are chiefly in deep holes, between weeds or stumps of trees, or on gravelly scours.

The perch affords the angler great diversion, and not only the baits are various, but the modes of using them. Of worms, the best kinds are small lob-worms which have no knot, brandlings, red dung-hills, or those found in rotten tan, all well scoured; the hook may be varied from No. 2 to No. 6, being well whipped to a strong silkworm-gut, with a shot or two a foot from it. Put the point of the hook in at the head of the worm, out again a little lower than the middle, pushing it above the shank of the hook upon the gut; take a smaller one, beginning the same way, and bring its head up to the middle of the shank only; then draw the first worm down to the head of the latter, so that the tails may hang one above the other, keeping the point of the hook well covered. This is the most enticing method that can be adopted in worm-fishing. Use a small cork float, to keep the bait at six or twelve inches from the bottom, or sometimes about mid-water; in angling near the bottom, raise the bait very frequently from thence almost to the surface, letting it gradually fall again. Should a good shoal be met with, they are so greedy that they may be all caught, unless one escapes that has felt the hook; then all is over, the fish that has been hooked becomes restless, and soon occasions the whole shoal to leave the place. Two or three rods may be employed, as they require time sufficient to gorge to allow the angler to be prepared to strike them. To draw these fish together, three or four balls of stiff clay should be procured, and holes made in them; one end of a lob-worm should be put in each hole, and the clay closed fast upon them; and these (a yard or two distant from each other) should be thrown into the water where it is proposed to angle; the worms being alive in the balls, by their moving or twisting about, tempt the fish to feed upon them; but the angler's worms being of a superior

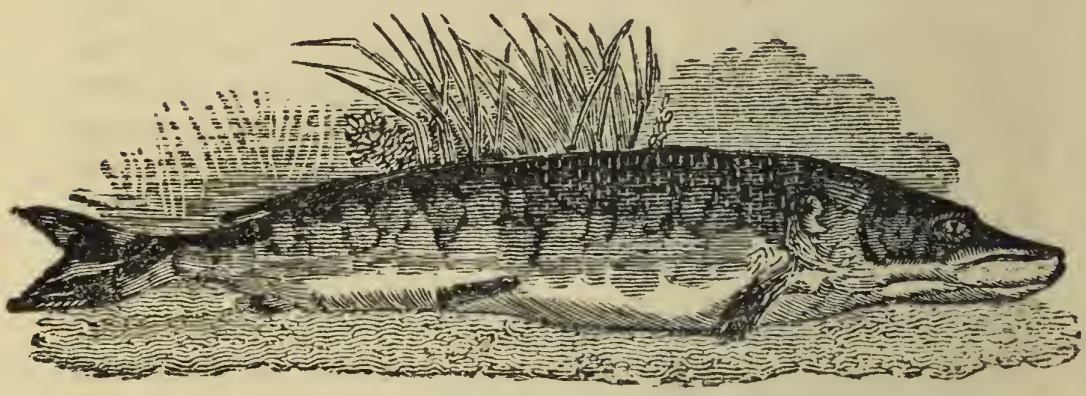
kind, they will, on sight of them, leave those on the clay, and seize with eagerness the others. Not perch only, but many sorts of fish, are collected by this ground-bait. In the same way, with complete success, at times the gentle and other baits may be tried.

In a bad day, when the perch will not thus be brought on feed, take off the float, and extend the line as long as the rod will throw the bait out (which should be worms) without injuring it; cast it in all directions, sometimes across, at others up or down the water, drawing the bait towards you, and playing with a similar motion as in spinning a minnow; try not long in one spot. When a fish bites, slacken the line, and give time before striking: this often succeeds in bad weather, when all other methods fail, but more especially in a rough southerly or westerly wind.

Other baits for the perch are roaches, sticklebacks with the spines cut off, miller's thumbs, horse-beans boiled (after the place has been well baited with them, put one at a time on the hook), cad-bait, bobs, and gentles. But the best and most enticing bait for a perch is a live minnow. Place a small reel on your rod, with about twenty or thirty yards of Indian twist, and a hook, No. 5, fastened to a link of gimp. Introduce your hook through the back fin of the minnow, and you will find this a killing bait, and have every chance of procuring some good fish.

Although generally termed a bold biter, the perch is extremely abstemious in winter, scarcely ever biting at that season, unless in the middle of a warm sunshiny day: he bites best in the latter part of the spring, from seven till eleven in the forenoon, and from two till six in the afternoon, except in hot and bright weather, and then from sunrise till six in the morning, and in the eve from six till sunset. If a day be cool and cloudy, with a ruffling south wind. perch, will bite during the whole of it. In clear water, sometimes a dozen or more of perch have been observed in a deep hole, sheltered by trees or bushes; by using fine tackle and a well-scoured worm, the angler may see them strive which shall first seize it, until the whole shoal have been caught. Perch may be angled for and taken until the end of September, and indeed, at particular times, all the year

round; but the preferable season is from the beginning of May till the middle of July.



THE PIKE.

THERE is scarcely any fish of its size in the world that in voracity can equal the Pike. One of them has been known to choak itself in attempting to swallow another of its own species that proved too large for its swallow.

In December, 1765, a pike was caught in the river Ouse, Yorkshire, that weighed upwards of twenty-eight pounds, and was sold for a guinea. When it was opened, a watch, with a black riband and two seals, was found in its body. These, it was afterwards discovered, had belonged to a gentleman's servant, who had been drowned in the river about a month before.

Pike spawn in March or April. When they are in high season, their colours are very fine, being green, spotted with bright yellow, and having the gills of a most vivid red. When out of season, the green changes to gray, and the yellow spots become pale. The teeth are very sharp, and are disposed in the upper jaw, on both sides of the lower, on the roof of the mouth, and often on the tongue. They are altogether solitary fish, never congregating like some of the other tribes.

Small fish show a similar uneasiness at the presence of the pike, as the little birds do at the sight of the hawk or owl; and when they lie dormant near the surface,

(as they frequently do in sultry weather) the lesser fish swim around in vast numbers, and with evident anxiety. Pike are often taken in the hottest part of the days in summer, while they are thus asleep by a noose of wire, fixed to a strong pole about four yards long; by which the wire with great slowness is conducted over the pike's head and gill-fins, and then hoisted with a jerk to land.

Pike are also frequently shot while thus basking themselves; the marksman aims directly under them: from the deception there is in the water, and its causing the shot to rise much when fired into, he would otherwise miss his object.

Pike are in season from May till February (the female fish are to be preferred), are bold biters, afford the angler good sport, and may be fished for all the year; but the best months (especially for trolling) are February, before the weeds shoot, and October, when they are rotted: the latter is to be preferred, as the pike fattened by their feed during the summer are then in the best condition for the table, while, from the lowness of the waters, their harbours are easily discovered.

For trolling, the rod should be twelve or fourteen feet long; but a strong top for this fishing, with a ring at the end for the line to run through, may be fitted to a fly or general rod. There should be one ring upon each joint to conduct the line, which is better than a greater number; and these rings must be set on straight. that it may run freely, and not be liable to sudden check after the bait is taken, which would prevent the pike from gorging it. The line should be of silk, with a swivel at the end to receive the armed wire or gimp, at least thirty yards longs, wound upon a winch or reel, fixed to the butt-end of the rod.

Hooks for trolling, called dead gorges, and other sorts for trolling, snap, and trimmer, and fishing needles, are to be bought at every shop where fishing-tackle is sold. In the choice of the first, let them not be too large, nor should their temper be injured by the lead on the shanks, or the points stand too proud; and, although usually sold on wire, it is recommended to cut off the wire about an inch from the lead, and with double silk, well waxed, fasten about a foot of good gimp to the wire, with a noose at the other end of the gimp, large enough to admit the bait to pass through, to hang it upon the line.

The best baits are gudgeons or dace, of a middling size. Put the baiting-needle in at the mouth, and out at the middle of the tail, drawing the gimp and hook after it, fixing the point of the hook near the eye of the fish; tie the tail to the gimp, which will not only keep it in a proper position, but will also prevent the tail from catching against weeds and roots in the water. Thus baited, the hook is to be fastened to the line, and dropped gently in the water, near the sides of the river, across the water, or where it is likely pike resort; keep the bait in constant motion, sometimes letting it sink near the bottom, and gradually raising it; the angler need not make more than two or three trials in a place, for if a pike be there, he will within that time bite, if he means to do so. When the bait is taken, if at a depth too great to see, it will easily be ascertained by the line beiug drawn tight, and by some resistance. Let the pike have what line he chooses,—it will be soon known when he has reached his harbour by his not drawing more; allow him from five to ten minutes, for his gorging the bait; wind up the line gently until the pike is seen, which he will permit, though he has not gorged. Should the bait be across his mouth, give more time; but if he has swallowed it, manage him with a gentle hand, keeping him, however, from roots and stumps, which he will try to fasten the line upon. In clear water, veer out line until he is sufficiently tired, and a landing-net can be used; but by no means, however apparently exhausted, attempt to lift him out with the rod and line only: for the moment he quits the water, he will open his mouth, his own weight will be almost sure to tear the hook from his stomach, and the fish will thus be lost to the angler, although it must inevitably perish.

In trolling, the bait should never be thrown too far: in small rivers the opposite bank may be fished with ease; though the violence of its fall upon the water, in extensive throws, soon spoils the bait, by rubbing off its scales, and alarms the pike, instead of enticing him.

The bead hook is used by putting the bead into the mouth of the live bait and sewing it up; the fish will live some time, and, notwithstanding the bead, will swim with the support he receives from the line, with nearly the same ease as if at liberty; this is the most successful way of tempting the pike.

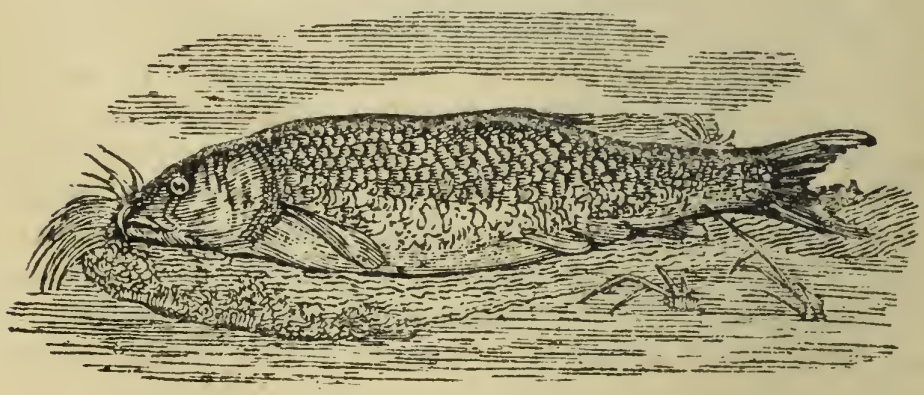
Pike are to be allured by a large bait, but a small one is more certain to take them: never suffer weeds to hang upon the hook or bait when recast in the water, and which cannot touch the surface too softly. Always prefer a rough wind, and when the stream is clear, for trolling: pike never bite in white water after rain, &c. If a pike goes slowly up the stream after taking the bait, it is said to be a signal of a good fish.

When fishing with a live bait for pike, I always prefer the perch, it being the longest lived on the hook, first cutting off the fin on his back, which is easily done without hurting him. The frog is the next good bait for this fish, but you must be careful to select the water frog, which breeds in ditches; and choose the yellowest, which the pike likes best. All others, such as the lopsit, the padock, or land frog, are considered venomous. Having caught your frog, to keep him alive on the hook as long as possible, use him thus: put your hook through his mouth—I mean, pass the arming-wire into his mouth and out at his gills, with a fine needle and silk; sew the upper part of his leg with a single stitch to the arming-wire of your hook, or tie the frog's leg, above the upper joint, to the arming-wire; and in so doing be careful to use him tenderly, that he may live the longer.—This you will find an excellent bait, as a ledger-bait.

If you bait your hook with a live frog or fish, you may have fun as well as sport, especially on a windy day, by fastening it to a bundle of straw, and then casting it on the water. By the help of the wind, it will float across a pond or down a stream; and if you stand still on the bank, you will soon see some sport, if there be any store of pike. Another angling joke consists in tying the live bait to the body or wings of a goose or duck, and then chasing it over the water, which will generally produce sport. Two or three baits may also be fastened to a bladder, or bough of a tree, or bottle of hay or flags, which will swim down a river, while you are walking quietly on the bank. The rest may be gained by practice and patience. The pike will often bite when not hungry, out of anger at a bait which may come near him.

In many parts of the Surrey Canal there are great quantities of small pike, which you may take by baiting

with a live minnow, passing the hook through the fin on the back; but the best place, and nearest to London, for good pike fishing, is Reading, 36 miles from London. If you feel inclined for a few days' trolling or fishing, you may here make sure of good and uninterrupted sport, the place being exceedingly retired and pleasant. The host of the house adjoining the bridge, called the George Inn, Mr. Waight, will supply you with a good punt, and, after your day's pleasure, good refreshment and bed at a very moderate expence. You may here almost fish out of the parlour window. The stream is a branch of the Thames, abundantly stocked with fish. The largest taken on this spot was a jack of twenty-eight pounds, shot by the then landlord, a Mr. Radborn. A painting of this fish, his exact size, used to hang up in the parlour. I have myself taken pike of fourteen pounds about this spot. For trolling no place can be better: I have here taken perch of three pounds and a half, and it abounds with roach, dace, chubb, &c. I have taken as many as ten dozen of roach and dace (half pound fish) before breakfast. In short, every thing an angler can wish for will be met with here, unless it be tackle, artificial bait, &c., with which I would recommend him to supply himself liberally, for he will want it, but will not easily procure it on the spot.



THE BARBEL.

THE Barbel is of a fine cast and handsome shape, with small scales, which are placed after a most exact and curious manner. He is able to live in the strongest

streams, but prefers shallow sharp ones in the summer. Barbel flock together like sheep; they lurk under weeds, and like to feed on a gravelly bottom, against a rising ground. They will root and dig in the sand like pigs, and there rest themselves. Sometimes they take to the deep and swift water about bridges or flood-gates, reposing amongst piles or in hollow places, where they will take such hold of the weeds that the swiftest streams cannot dislodge them. They hide their spawn in holes they dig for the purpose in the gravel, and cover it over with gravel, to prevent it from being devoured by other fish. This is done in quiet and deep places. The barbel only breed and thrive in rivers. In the Thames there are many, fine and large, and some in the Lea.

As a table fish the barbel is not admired. The flesh is considered unwholesome, the spawn almost poisonous, especially in the month of May.

But to the angler the barbel presents great attraction, being a game fish, affording excellent sport, mixed with some labour and anxiety. When of a large size, the barbel is exceedingly crafty, sulky, and strong, struggling a long time after he is hooked, often lying motionless at the bottom many minutes, then running under banks, or into large beds of weeds, where he will probably strike your line with his tail till he breaks it. In fact, barbel try every possible way to get off the hook, or break the line, which they certainly will effect if you are deficient in skill, or your tackle is in any way faulty. So cunning is the barbel, that he will suck or nibble off your worm close to the hook, and after that I defy you to hook him. This I have often experienced when fishing at or near Hampton Bridge.

The barbel bites very sharp and sudden; you must strike on the instant, and smartly; immediately raise the top of your rod, keeping your line not too tight. Let him run some considerable distance before you attempt to turn him, then endeavour to keep your fish away from the shelves and beds of weeds. Draw him from the current into deep and still water as soon as possible, and play him till he has quite lost his strength before you attempt to land him.

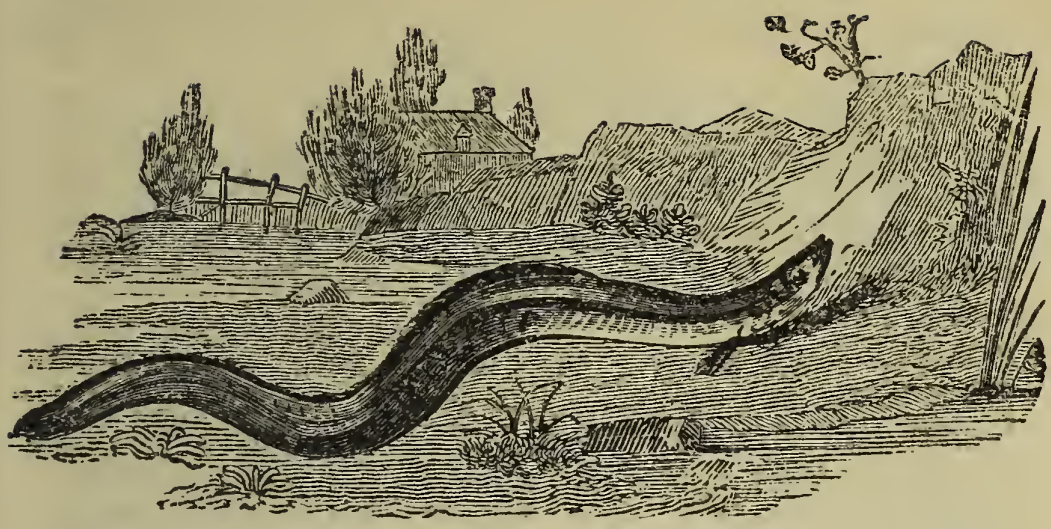
Before you begin to angle for barbel, throw in plenty of ground-bait (you can hardly give them too much), and

continue to do so frequently while fishing for them. The best ground-bait is made with soaked greaves and clay, mixed together in balls the size of an egg, also clay and gentles; indent a piece of clay, in which put some gentles, close it lightly, and the gentles will work out gradually when at the bottom of the river. Use this ground-bait only in still holes. A quantity of worms, chopped into small pieces, are likewise a good ground-bait.

In baiting for barbel, be sure to have your baits clean and sweet, and the worms well scoured, for he is a curious and dainty feeder. The best of all baits is a well scoured lob-worm, especially if you should ground-bait the place the night before you intend angling. They will also bite at gentles; but green ones are the choicest bait for him. Cheese, also, which is not too hard, soaked a day or two in a wet linen cloth to make it tough, is very geod: this you may likewise ground-bait the place with. If a little clarified honey was worked into the cheese an hour or so before using it, you would perhaps be more likely to be successful; but, above all, the lob-worms are as good a bait as any, provided they are well scoured, though it always becomes the angler to try at improvement; and there are many other baits, such as sheeps' tallow and cheese worked together into a paste.

The tackle that I should recommend my little angler, and which I have always found the best, is a long rod of good strength, for he will find the barbel a heavy and dogged fish to deal with. If once hooked, however, he seldom escapes from a good sportsman.

The barbel feed from May till October, all the day, but best in the morning and evening; indeed, the chance of success increases with the coming night. They will even bite all night, and will feed very freely after rain, when the water is thickened a little.



THE EEL.

THERE are various kinds of eels,—the silver eel, the common black eel, grigs, &c., varying much in colour, from a dusty black to a bright green. The silver eel has a white belly, and has a clear bright appearance.

The Grig is an eel of a smaller kind, mostly to be found about the Thames, up as far as Oxford. Many are to be taken about Westminster Bridge aud upwards. In Spring they bite freely, when the common silver eels will not.

The eel is the longest-lived fish out of water. When caught, the best means of killing it is to take your baiting-needle and pierce it in the centre of its head. It is an unpleasant fish to angle for; for, by its gorging the bait and hook, you are continually obliged to use your disgorger. However, by thrusting the forked end of the hook downward, and holding the line tight with the other hand, you may easily draw the hook out without hurting or damaging the point or bait, which is most essential to a good angler.

The principal haunts of the eel are under the roots of old trees, holes and clefts of banks—weeds and stumps of trees—in the plain mud, lying in wait for their prey —and under large stones, mill-dams, flood-gates, &c. When the water is rather thickened by rain, they feed greedily.

In angling for eels, let your bait drag on the ground, and fish either with a large garden-worm or the lob-

worm: the latter is preferable—in the months of May to July, in cloudy weather attended with thunder and lightning.

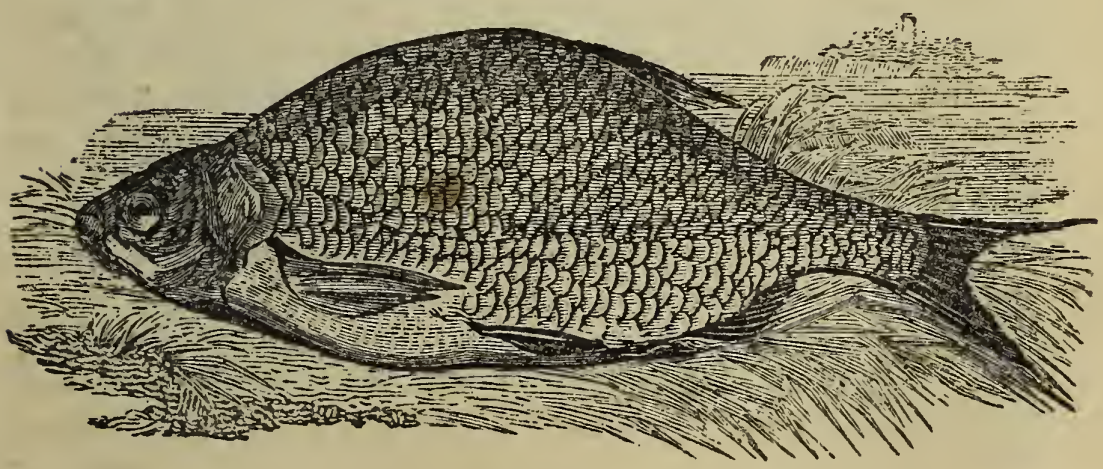
But the night angling is far the best for eels, when the weather is hot, and the nights are dark. On shallow gravelly bottoms they will seize the bait sharply; but give them time, and there will be no lack of good sport till daybreak, when they return to their holes.

The largest eels are to be taken by night-lines, wound round a bank-runner, and baited with small roach, dace, bleak, or frog, &c. The live gudgeon is, however, better than either of these. You must have a strong line and a gimp hook, with a bullet fastened about three feet from the bait, so as to allow the fish to swim freely. Secure your runner in the bank, and drop the line about four yards into the water. Attend to it early in the morning, as the eel, when hooked, will struggle greatly to free himself. There are other modes of taking the eel, such as sniggling, bobbing, &c.

Bobbing.—A method of taking eels. It is practised in a boat, with a large bunch of worms suspended by a strong cord from a hole or stout rod, in the following manner. First of all, you must procure a large quantity of worms (marsh worms are best, though lobs will do), and string them on worsted or coarse thread, by passing a needle through them from head to tail, until you have as many strung as will form a bunch as large as a good-sized turnip; then fasten them on the line, so that all the ends may hang level: in the middle is placed a piece of lead, of a conical or bell form, the broad end downwards, which may be got at any of the fishing-tackle shops, made for the purpose. Thus prepared, cast the baits into the water gently, let them sink to the bottom, and then keep raising them a few inches from the ground, and dropping them again until you have a bite, which is easily perceived, as the eel tugs very strongly: be as expert as possible, at the same time steady, in raising your line, so that your fish, in dropping off, may fall into the boat. Immense numbers are taken by this method. During the hot weather, always fish or bob in shoal, or rather shallow water, and out of the stream. Most are taken during the night; but they will lay hold freely in the day-time. Rivers in which the tide flows afford the best success, particularly during ebb tide.

THE POPE, OR RUFFE.

THIS is an excellent fish for a young angler to practise with, for he is a greedy biter. He his not, however, to be met with in all rivers; but in deep waters they often lie together in shoals. The pope is much like the perch in make and flavour, and by many is considered superior. In size, he seldom exceeds the gudgeon. To fish for the pope, bait the ground with small pieces of red worm combined with earth or clay, which you will find better than any other ground-bait. Your tackle should be of single hair, but strong, with a hook No. 6 or 7, and a small porcupine float. The rod should be of light bamboo cane. Angle near the ground; and, after a little experience, if the spot be well chosen, the tyro will be enabled to take fifty or sixty at one standing. The pope is a long-lived fish.



BREAM.

BREAM are to be found in many parts of the Thames and the Lea, but are more plentifully to be met with

in the Trent, Wey, and many other rivers; also at Blackwall, in the wet-docks. In fishing for them, take a gut line, with hook No. 8 or 9, running-tackle and winch, a quill float, and long rod. Ground-bait the place you intend fishing in with greaves, or bran and clay, well mixed, and thrown into the water in small balls. A few chopped worms introduced will be a great addition. Your baited hook must drag half an inch on the ground in streams; and you must fish early in the morning or late at night, as bream will not feed in the middle of the day. The months in which they bite most freely are March, April, and May; when the wind blows, or warm rains fall, they will bite all day, provided you have taken care to have your place well baited the previous night. Bream will take gentles, paste, &c., but the scoured marsh-worm is far the best. In angling for bream, be sure to fish out far in the stream—much farthar than if you were angling for roach; and, when you have a bite, strike immediately.

There are many bream to be taken in a still piece of water to the right of Isleworth Bridge; and a pleasant spot it is, overhung with large willows, and free from any interruption. Here you may use two rods and lines. Placing a rod over some rushes or the bough of a tree, throw your baited hook a considerable distance into the water. The bait must hang just clear of the ground (to ascertain which you should previously plumb the depth), so that a slight breeze may move it. Be careful to stand a little back, waiting quietly for a bite: by so doing you may expect good sport and a plentiful supply of fish, for the bream is a fast-biting fish, and affords much amusement to the angler, though but little to the gourmand, being terribly bony. Bream are generally to be found where there are carp and tench. They are sometimes as much as six pounds in weight, and will struggle hard, when first hooked; but give them plenty of line before you attempt to turn them; for, like the barbel, they are of a sulky disposition, and will remain quietly for some time, and then make a rush for the bank, weeds, &c.

THE WHOLE
ART OF SWIMMING.

It is universally admitted, that a knowledge of the art of swimming is both a useful and elegant accomplishment, and it is much to be regretted that greater pains are not bestowed upon the acquisition of it.

That man has not the same, or an equal facility in swimming with many of the inferior animals, is a face which is familiar to every one, and can be easily accounted for. Whilst other animals are possessed of instinct, by which, without any process of reasoning, they are invariably led to the adoption of the means that are most suitable for the attainment of the end, man, in this, as well as in an infinite variety of other instances, is chiefly left to the guidance of his reason; and all

reasoning must favour the cultivation of the art of swimming.

In addition to its advantage as a healthy and bracing exercise, humanity alone, the pleasure of being not only able to preserve our own lives, but those of others, ought certainly to be sufficient inducement to acquire a dexterity in this most useful art. When it is considered that ours is a country having the ocean for its frontier, and that in the interior there is none in the world more abounding in rivers, brooks, lakes, and artificial canals, it may seem surprising that such a proportionately small number of its inhabitants can swim. It might have been much more naturally inferred, that every inhabitant of our island would feel almost as much at ease in the water as on dry ground. The upsetting of the slender boats of the natives of Otaheite is to them a subject of merriment; they swim about, catch hold of the light vessel, right her again, and paddle away, never considering they have been in any danger. Were the practice of swimming universal in this country —and it might be so—we should hardly ever hear of deaths by drowning.

The human body being specifically lighter than water, no doubt can be entertained that man can naturally swim, like other animals. The cause of his apparent inferiority proceeds from fear or impatience, which induce him to struggle in the water; and this, besides exhausting his strength, has the effect of making him sink. No one can ever swim, and, what is more, no one can ever be taught to swim, who has not overcome that timidity. It is by repeated practice alone, that perfection in the art of swimming can be attained: and in this it resembles every other art. When once gained, it never can be forgotten, and may prove of the most essential service to persons exposed to hazard by sea, or who are accidentally thrown into difficult situations by water. Let it never be forgotten, that we ought in such cases to be particularly careful to maintain the greatest composure of mind, and not to rely too much upon our acknowledged expertness in the art; for in the hurry and confusion which naturally attend such scenes, we are too often apt to be rash in our calculations, and thus run into unnecessary danger.

GENERAL REMARKS.—TIMES AND PLACES FOR BATHING, &c. &c.

The sea is the best for bathing, running waters are the next, and ponds the worst. The numerous public baths about the metropolis have many advantages, and are infinitely less objectionable than ponds, on account of the care taken to have a constant change of water. The times at which bathing is most wholesome are the months of May, June, July, August, and September. It is not advisable to bathe in rainy weather, as rain, if it lasts, speedily chills the water, and subjects to cold by wetting the clothes. Night is also a bad period, as it is unsafe to expose the naked person to the night air. If possible, select a place with a bottom of gravel or smooth stones, so that you may stand thereon as freely as on the earth, without danger of either sinking in mud, or wounding the feet. Avoid a weedy bottom, as, although you may have companions, your feet may become entangled when their attention is diverted, and you thus be lost before they are apprised of your danger. You should never enter water that you have not first plummed. If ever so good a swimmer, it is important to be sure that you can plunge in without danger of striking the bottom: if not so well experienced, it not only gives confidence to know that the bottom is within safe reach, but as the novice is early tired, it is indispensable that the bottom should not be out of his reach when he has occasion to take rest.

CORKS, BLADDERS, AND OTHER AUXILIARIES.

The use of corks, bladders, &c., is as strongly reprobated by some as it is commended by others. That the necessary action may be more easily taught with them than without them, is undeniable; but confidence is the great essential to good swimming, and if the learner cannot command this without corks, he is not likely to acquire it any the more quickly by the use of them. We would rather, therefore, let him make slower progress without such aids. Indeed, we have known instances of parties who have become good swimmers with corks, that could scarcely keep their heads above water when they attempted to lay them aside. It is after the learner has made some progress—when he can

cross a moderate stream, for instance—that corks may be best resorted to, to enable him to remain long enough in the water for the practice of the various movements essential to his becoming a good and graceful swimmer.

Swimming-corks consist of three or four rounds or slices of cork, of progressive sizes, run, by a hole made through the centre, on to either end of a stout cord, with a knot well secured at each end. The cord should be somewhat longer than the breast of the swimmer is wide, so as to admit of the corks floating round to his back. The swimmer is to lay his chest on to the cord, letting it pass close under his arms, and the corks will then take their proper positions, as represented in our engraving. Bullocks' bladders, inflated, will answer the same purpose; but, as their buoyancy depends altogether on their continued inflation, and there is the danger of the air escaping from the mouths of the bladders being insecurely tied, and other casualties, we do not recommend their adoption

where corks can be obtained. It may be here observed that the hands and arms are mainly serviceable in swimming for the purpose of keeping the body in buoyancy. The legs are the implements of progression; and the best argument that can be advanced in favour of the use of corks, &c. &c., is that, by not occupying the attention of the learner with the necessity of using his arms in the way indicated, he will be the more likely to perfect himself in the management of the limbs essential to his rapid progression. For this purpose, other expedients are often adopted. A rope is sometimes fastened, so as to reach the water, from an overhanging bough or a projecting post, by taking hold of which, the learner may dispense with the use of his hands while practising the action of his legs. But a better plan even than this, where there is space enough of water to admit of it, is to have a plank floating on the bath. The least hold of this plank will prevent the learner from immersion, and he will have the gratification of testing the efficiency of his operations by the rate at which he moves with his floating protector.

OF GOING INTO THE WATER.

Those who do not know how to swim, ought to enter by degrees, and gently, into the water; but those who are expert may leap in at once, with their head or feet perpendicular to the bottom. Others hold their right hand or both hands behind their neck, and cast themselves in head foremost, striking the water with the calves of their legs one after another. Some, after a short race, fling themselves into the water on their right or left side. Others, taking a short run towards the bank of the river, leap in with their feet foremost, and body upright, meeting the water first with their buttocks and the calves of their legs. This way is very safe, and therefore to be recommended.

There is nothing objectionable in any of these methods, except the hazard of taking in water at the nose and ears; but that may be avoided by holding in the breath. It sometimes happens that those who are least expert go to the bottom, which is unpleasant, by reason of sometimes striking against it, and that in a great depth you are obliged to hold your breath longer than

agreeable: but you may remedy that by turning on your back as soon as you begin to approach the bottom, for you will cease descending as soon as you begin to turn yourself. Whatever the mode of entering the water, it is generally agreed that the head should be the first part wetted; so that, if the bather does not adopt the plan of plunging in head foremost, he should sluice it with water before walking in.

TO BEGIN TO LEARN TO SWIM.

It is a good plan, on first entering, to make a plunge, and then take a short run along the bank before indulging in the exercise of swimming; you will not then be so liable to feel chilly. Do not remain over long in the water: leave it as soon as you feel tired, chilly, or numbed. To put yourself in a right posture for swimming, lie down gently on your stomach, keep your head and neck upright, your breast advancing forward, your back bending, withdraw your legs from the bottom, and immediately, but not hurriedly, stretch them out in imitation of a frog; strike out your arms forward, and

spread them open; then draw them in again towards your breast, strike forward, making use first of your feet, then of your hands, as many strokes as you can. If these instructions are attended to, you will swim. You need not at all fear lying along the water when you know the bottom. It will sometimes happen that you swallow some water, but that ought not to discourage you, for the same thing happens almost to all beginners.

The novice in swimming should take special care that the water be not higher than his breast, nor shallower than up to his belly.

HOW TO TURN.

To turn back, you must turn the palm of your right hand outwards from you, and strike out the arm the same way, and do exactly the contrary with your left hand and arm, striking that inwards the contrary way, embracing as it were the water on that side. Thus, you may turn yourself also on the left, after having inclined your head, neck, and the length of your body to that side.

TO TURN WHEN SWIMMING.

Incline your head and body to the side you wish to turn to, and at the same time move and turn your legs, after the same manner as you would to turn the same

way on land: this at once stops the motion of your body forwards.

If you wish to turn to the left, you must turn the thumb of your right hand towards the bottom, and with the palm open, but somewhat bent, drive off the water from that side; and, at the same time, with the left hand open and fingers close, drive the water on that side backwards, and at once turn your body and face to the left. If you would turn to the right, you must do just the same thing contrariwise.

TO FLOAT AND SWIM WITH THE FACE UPWARDS.

It is strange that so many should die by drowning, while floating is so simple, and so sure, that if a person will only put himself in a floating position, he cann t sink; which is accomplished by turning himself on his back, keeping his body extended in a right line, and placing his hands on his stomach.

This done, the best of divers cannot descend without elevating their arms, and contracting the thorax or breast; and then their descent will be very gradual. As long as you can hold your breath and keep this position, you will float without further effort, and you

can also keep yourself floating during respiration, by gently paddling with the hands by the sides of the hips.

TO SWIM IN THE FLOATING POSITION.

To do this you must turn yourself on your back as gently as possible. Strike out with the legs, taking care not to lift the knees too high, nor sink your hips and sides too low; but keep in as straight a line as possible. You may lay the arms across the breast, place them motionless at the sides, or strike out with them to help you on.

To swim with the feet forward, while on your back, lift up your legs one after the other, let them fall into the water, and draw them back with all the force you can, towards the hams.

TO TURN LYING ALONG.

It would seem, at first sight, as if to turn oneself, and to turn oneself lying along, were the same thing. But to turn lying along, you must keep in an extended posture, and lying on the back, the top of your arms close to your sides, turning the lowest joint of your right hand outwards, the legs at a distance one from another at least a foot, or thereabouts, and the soles of your feet turned towards the bottom of the water. In this posture, you may turn as you please towards the right or left side. These different modes of turning are very serviceable, in case of running into weeds or against a bank. The following, however, is another way of disengaging oneself from weeds:—

ANOTHER WAY OF TURNING OR ROLLING ROUND.

There is a way of turning round as a globe does about its axis. If you are swimming on your stomach, and would turn to the left, extend your right hand and arm as far out before you as you can, and turn your face, breast, and whole body, to the left, lifting up your right hand towards the top of the water, and you will find yourself on your back, and from your back you may turn again on your stomach, and so on as often as you please. Take care to keep your legs close together, and your arms stretched out before your breast, but not separated from one another.

THE TURN CALLED RINGING THE BELLS

You have no need of much room for this mode of turning, and may do it either swimming on the back or stomach. If you are swimming on the stomach, draw in your feet and strike them forwards, at the same time striking out your hands backwards, and putting your body in an upright posture.

If swimming on the back, draw in your legs towards your buttocks, and, striking them down towards the bottom, cast your body forwards till you are turned on the stomach; but take heed that you have water sufficient, and that there are no weeds at bottom, as, if you either strike the bottom or get your legs among the weeds, the consequences may be serious.

TO MAKE A CIRCLE.

Keeping one foot inmovable, turn the other round, and thus describe a circle, ending where it began: in the same manner the head may remain immovable, while the legs strike the water, and make the body turn round. To perform this, the body lying on the back, if you would turn from the right to the left, you must first sink your left side somewhat more towards the bottom than the other, and lift out of the water your legs successively, first the left, then the right, and at each of these motions advance your legs outwards about a foot each, towards the left side, your head remaining still in the same place: the eddy on the surface of the water will show the parts of the circle you have described. This movement may serve to remove any thing from the head or feet. In the practice of it you must take care not to elevate your feet too high in the air, for that would immerse the head, nor to strike the water too hard with the feet.

TO TURN IN THE WATER IN AN UPRIGHT POSTURE.

While in the water, in an upright posture, you may turn and view every thing around. To turn to the right, in the first place, press the water with the sole of the right foot, and afterwards with that of the left, at the same time inclining the body towards the left; draw the water as much as you can towards you with your hands, and afterwards drive it off again; first with the left hand, and then with the right. This manner

of swimming may be very useful, especially where it is so desirable to look often about you, to guard against the possibility of your being carried further from land than you calculate on.

TO ADVANCE WITH THE HANDS JOINED TOGETHER.

This is one of the most simple ways of swimming, and is also very graceful. In the practice of it you hold your hands joined together, successively drawing them in towards the breast, and striking them out again. The two hands remain all the while joined, and the thumbs and fingers, being turned towards the surface of the water, seem to be out of it. Besides the gracefulness of this way of swimming, it is also serviceable for traversing or swimming across a heap of weeds, &c.; for the hands, being thus joined as it were in a point, open a passage for you, especially if you take care not to strike them out too far.

TO SWIM ON THE SIDE.

While swimming on the back or stomach, lower or sink the left side, and at the same time elevate the right one. When thus laid, move the left hand as often as convenient, without separating it far from the body, or sinking it, perpetually striking it out and retracting it as in a right line on the surface of the water. By this mode of swimming, you may rest one side while the other is employed.

TO SWIM ON THE STOMACH, HOLDING BOTH HANDS STILL.

This is easily performed: keep your breast advancing forward, your neck upright on the water, both your hands fast behind your head, or on your back, while in the meantime your legs and thighs push you forwards by the same motions you make when swimming in the ordinary way. This way of swimming may be useful in case of cramp happening to your arms.

TO CARRY THE LEG IN THE HAND.

When swimming on the stomach, if you lift up one leg, and, moving it towards the buttocks, take hold of it with the hand of the opposite side, you may continue to swim with the leg and other hand which are at liberty.

To swim like a dog, lift up and depress one hand successively after another, and do the same also with the feet, with this difference only, that with the hands you must draw the water towards you, and with the feet drive it from you. Begin with the right hand and right foot, following with the left hand and foot, and so successively.

TO BEAT THE WATER.

When swimming on the back, at each extension of the legs, lift them up out of the water, one after the other, and strike the water so that it will rebound into the air. Those who are most expert at this bring their chins towards their breast at each extension.

TO KEEP ONE FOOT ABOVE THE WATER.

This is a mode of swimming more for diversion than advantage. Keep the breast inflated, the palms of the hands extended and turned downwards toward the bottom, and the other leg constantly employed in the water; for, if you omit any of these precautions, your head immediately sinks down.

TO SHOW BOTH FEET OUT OF THE WATER.

It is practicable not only to float with both feet out of the water, but also to make advances forward. Place yourself on the back, and bend the small of it contrariwise to what is practised in other ways of swimming; the hands must be on the stomach, the palms of them open, moving them to and fro like oars, which must sustain the body while the feet are shown.

TO SUSPEND YOURSELF BY THE CHIN.

By this means you may apparently stand upright in the water, though ever so deep. To make you comprehend, remember, that when you swim on your back, you lie still, your legs being extended; when in that posture, you are to let your legs go down or sink; and when they come to the perpendicular, you must take them up again, bending the knees, and inflating the breast; and as to the arms and hands, whereof the back parts lie flat on the water by the shoulders, you must extend them sometimes on one side, sometimes on the other, and sometimes shut them, turning the palms

towards the bottom, the fingers close to one another, holding your chin as upright as possible. This mode of sustaining the body is very useful to skaters, if the ice should happen to break under their feet.

TO TREAD WATER.

By this feat you remain upright in the water without making any motion with your hands, only you move the water round with you legs from you, the soles of your feet being perpendicular to the bottom. A person might sustain himself by this movement, even if he were cast into the water bound hand and foot. Treading the water has also the advantage of allowing the free use of the hands.

TO SWIM WITH THE LEGS FASTENED TOGETHER.

The legs being bound either by weeds or otherwise, turn on your back, and lay your hands across on your breast, for in that posture you may gain the shore, by striking your legs one against another, and holding them up as much as you can.

TO CREEP IN THE WATER.

Being on your stomach, cast your hands forwards, and your feet backwards, but close together, and thus advance, extending your arms and hands as far from your breast as possible, your fingers close, and the palms of your hands a little bent, and turned towards the bottom: for, being in this posture, if you draw toward your breast with your hands and arms the water that is before you, by that you give time to the rest of your body to advance.

TO SIT IN THE WATER.

Expert swimmers can do whatever they please in the water: they can walk therein, stand perfectly upright, lie still, or even sit down on it. To sit, you must take both your legs in your hands, draw in your breath, and so keep your breast inflated, your head upright, and lifting up successively your arms and legs, by that motion sustain yourself.

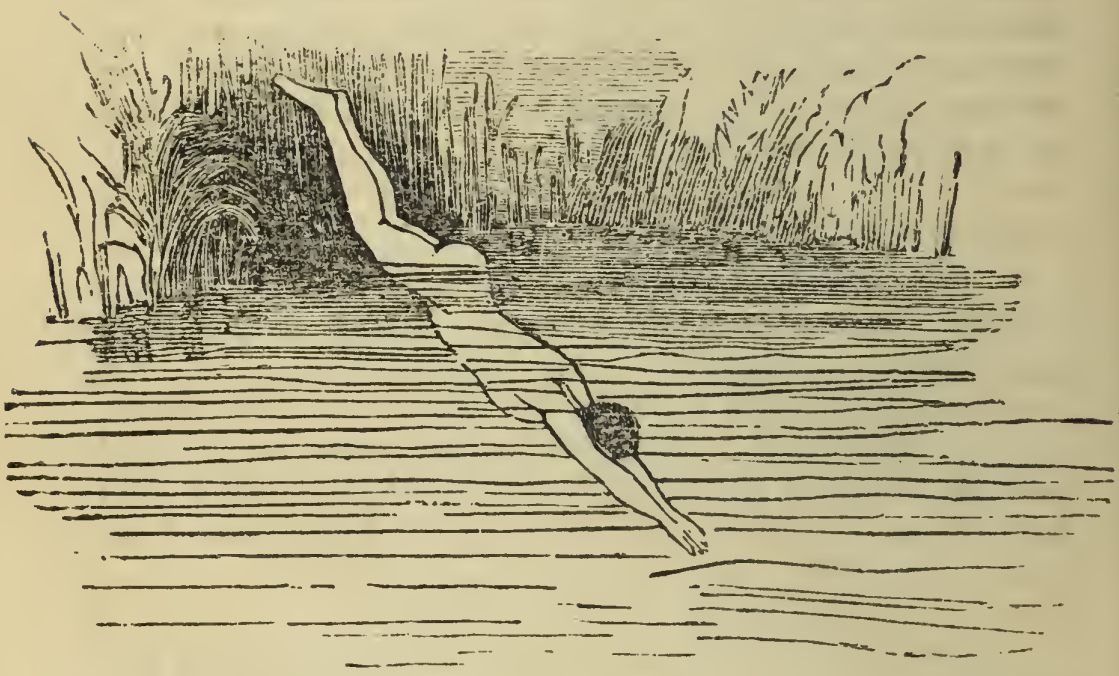
TO SWIM HOLDING UP ONE LEG.

This way seems at first to be the same with that of showing the feet out of water, which we have already described, but it is very different; for while you hold

up one of your legs, both your hands must embrace and gather together (as it were) the waters, striking them under you, and driving them off; the other leg must not be lifted up above half way, beating the water frequently therewith, by quick and short strokes.

TO SWIM HOLDING UP BOTH HANDS.

While swimming on your back, it is easy to put your hands to what you please, but it is difficult to hold them upright, and swim at the same time. This is, however, to be acquired by practice. You must take care, while you lift up your arms, that the thorax or breast be not contracted, for in that case you sink, the whole art of this way of swimming consisting in heaving up the breast high, and keeping it as inflated as possible.



DIVING.

If people sink to the bottom of the water, it is their own fault—nature has laid no necessity on them for doing so; indeed, there is occasion for some degree of force and strength to effect it safely, speedily, and handsomely; but the expert in swimming do it as swiftly as an arrow, and descend perpendicularly or obliquely, as they please. Begin with your feet touching the bottom; then rise up, your head bowed down so that your chin touches your breast; turn the crown of your

head towards the bottom, holding the backs of your hands close together, right before your head, and sinking or striking them down with all the swiftness and exactness you can muster; and thus you may dive to the bottom.

To dive from a height into the water, as from a bridge or ship, take a leap a little forward, and sometimes upward, that your descent may be perpendicular and swift, and also that your head may go perpendicularly downward, which is the best way when you have very deep water, on account of the difficulty of holding the breath for any length of time.

After you are at the bottom, you may return with the same facility, by the process we have already explained for swimmers to turn in the water. The swimmer, with one of his hands extended, must push from him the water before him with his palm, and with the cavity of the other palm draw toward him the water that is behind; when his hand is extended as far as it can be, the fingers of the hand so extended, and the palm of that turned outward, ought to be shut or clenched.

TO SWIM UNDER WATER.

This may be accomplished by the ordinary stroke, taking care to keep your head a little down, and to strike a little higher with the feet, than when swimming on the surface; or the thumb may be turned downward. and the stroke performed in that position, instead of keeping them flat. This, in addition to the instructions above given, will, with practice, render the party an accomplished diver..

THE CRAMP.

A treatise on bathing would be incomplete without a mention of this, the bather's bane; and the best reason that can be adduced for perfecting himself in the various modes of swimming herein detailed, is that, by the adoption of one or other of them, he may reckon on escaping the danger that this visitation undoubtedly subjects the swimmer to. At the same time, we feel bound to say, that a person habitually liable to cramp should not bathe in situations where assistance may not be immediately available. To a tolerable swim-

mer, however, there is little danger, if he maintains his self-possession. Cramp is a contraction of the sinews, of the legs or arms generally. The moment you feel it, if in the leg, strike out the limb with all the energy you can muster, without regard to the temporary pain you will have to endure, thrusting the heel out and drawing up the toes. If the cramp be in the arm, which is much less likely, adopt the like plan, shutting and stretching out the fingers with firmness. If the contraction do not yield to the first or second effort, throw yourself on your back, and endeavour to keep afloat till either the affection relapses or you obtain assistance. Out of the reach of aid, with calmness and decision, by one or other of the modes of swimming herein inculcated, you will be almost sure of paddling to the shore.

In connection with this subject, and as an exemplification of the ease with which one may support another in the water, we refer to the engraving of one borne up by another by simply applying a hand to each hip of the swimmer, at the opening of this little essay.

DR. FRANKLIN'S ADVICE TO SWIMMERS.

The only obstacle to improvement in this necessary and life-preserving art, is fear; and it is only by overcoming this timidity, that you can expect to become a master of the following acquirements. It is very common for novices in the art of swimming to make use of corks or bladders to assist in keeping the body above water; some have utterly condemned the use of them; however, they may be of service for supporting the body, while one is learning what is called the stroke, or that manner of drawing in and striking out the hands and feet, that is necessary to produce progressive motion. But you will be no swimmer till you can place confidence in the power of the water to support you. I would, therefore, advise the acquiring that confidence in the first place; especially as I have known several, who, by a little practice necessary for that purpose, have insensibly acquired the stroke, taught, as it were, by nature. The practice I mean is this: choosing a place where the water deepens gradually,

walk quietly into it till it is up to your breast; then turn round your face to the shore, and throw an egg into the water between you and the shore: it will sink to the bottom, and be easily seen there if the water be clean. It must lie in the water so deep that you cannot reach to take it up but by diving for it. To encourage yourself, in order to do this, reflect that your progress will be from deep to shallow water, and that at any time you may, by bringing your legs under you, and standing on the bottom, raise your head far above the water; then plunge under it with your eyes open, which must be kept open before going under, as you cannot open the eyelids for the weight of water above you; throwing yourself toward the egg, and endeavouring, by the action of your hands and feet against the water, to get forward, till within reach of it. In this attempt you will find that the water buoys you up against your inclination; that it is not so easy to sink as you imagine, and that you cannot, but by active force, get down to the egg. Thus you feel the power of the water to support you, and learn to confide in that power; while your endeavours to overcome it and reach the egg, teach you the manner of acting on the water with your feet and hands, which action is afterwards used in swimming to support your head higher above the water, or to go forward through it.

I would the more earnestly press you to the trial of this method, because, though I think I shall satisfy you that your body is lighter than water, and that you might float in it a long time with your mouth free for breathing, if you would put yourself into a proper posture, and would be still, and forbear struggling; yet, till you have obtained this experimental confidence in the water, I cannot depend upon your having the necessary presence of mind to recollect the posture, and the directions I gave you relating to it. The surprise may put all out of your mind.

Though the legs, arms, and head of a human body, being solid parts, are, specifically, somewhat heavier than fresh water, yet the trunk, particularly the upper part, for its hollowness, is so much lighter than water, as that the whole of the body, taken altogether, is too light to sink wholly under water, but some part will remain above, until the lungs become filled with water, which happens from drawing water to them instead of air, when a person,

in the fright, attempts breathing, while the mouth and nostrils are under water.

The legs and arms are specifically lighter than salt water, and will be supported by it, so that a human body cannot sink in salt water, though the lungs were filled as above, but from the greater specific gravity of the head. Therefore, a person throwing himself on his back in salt water, and extending his arms, may easily lay so as to keep his mouth and nostrils free for breathing; and, by a small motion of the hand, may prevent turning, if he should perceive any tendency to it.

In fresh water, if a man throw himself on his back, near the surface, he cannot long continue in that situation but by proper action of his hands on the water; if he use no such action, the legs and lower part of the body will gradually sink till he come into an upright position, in which he will continue suspended, the hollow of his breast keeping the head uppermost.

But if, in this erect position, the head be kept upright above the shoulders, as when we stand on the ground, the immersion will, by the weight of that part of the head that is out of the water, reach above the mouth and nostrils, perhaps a little above the eyes, so that a man cannot long remain suspended in water, with his head in that position.

The body continuing suspended as before, and upright, if the head be leaned quite back, so that the face look upward, all the back part of the head being under water, and its weight, consequently, in a great measure supported by it, the face will remain above water quite free for breathing, will rise an inch higher every inspiration, and sink as much every expiration, but never so low as that the water may come over the mouth.

If, therefore, a person unacquainted with swimming, and falling accidentally into the water, could have presence of mind sufficient to avoid struggling and plunging, and to let the body take this natural position, he might continue long safe from drowning, till, perhaps, help should come; for, as to the clothes, their additional weight when immersed is very inconsiderable, the water supporting it; though, when he comes out of the water, he would find them very heavy indeed.

But, as I said before, I would not advise you, or any

one, to depend on having this presence of mind on such an occasion, but learn fairly to swim, as I wish all men were taught to do in their youth; they would, on many occasions, be the safer for having that skill; and, on many more, the happier, as free from painful apprehensions of danger, to say nothing of the enjoyment in so delightful and wholesome an exercise. Soldiers particularly should, methinks, all be taught to swim; it might be of frequent use, either in surprising an enemy or saving themselves; and if I had now boys to educate, I should prefer those schools (other things being equal) where an opportunity was afforded for acquiring so advantageous an art, which, once learned, is never forgotten.

I know by experience, that it is a great comfort to a swimmer, who has a considerable distance to go, to turn himself sometimes on his back, and to vary, in other respects, the means of procuring a progressive motion.

When he is seized with the cramp in the leg, the method of driving it away is, to give the parts affected a sudden, vigorous, and violent shock; which he may do in the air as he swims on his back.

During the great heat in summer there is no danger in bathing, however warm we may be, in rivers which have been thoroughly warmed by the sun. But to throw one's self into cold spring water, when the body has been heated by exercise in the sun, is an imprudence which may prove fatal. I once knew an instance of four young men, who, having worked at harvest in the heat of the day, with a view of refreshing themselves, plunged into a spring of cold water; two died upon the spot, a third next morning, and the fourth recovered with great difficulty. A copious draught of cold water, in similar circumstances, is frequently attended with the same effect, in North America.

The exercise of swimming is one of the most healthy and agreeable in the world. After having swam for an hour or two in the evening, one sleeps coolly the whole night, even during the most ardent heats of summer. Perhaps the pores being cleansed, the insensible perspiration increases, and occasions this coolness. It is certain that much swimming is the means of stopping a diarrhœa, and even of producing a constipation. With respect to those who do not know how to swim, or who are affected with a diarrhœa at a season which does not perm.. them to use

that exercise, a warm bath, by cleansing and purifying th skin, is found very salutary, and often effects a radical cure. I speak from my own experience, frequently repeated, and that of others to whom I have recommended this.

When I was a boy, I amused myself one day with flying a paper kite, and approaching the banks of a lake, which was near a mile broad, I tied the string to a stake, and the kite ascended to a very considerable height above the pond, while I was swimming. In a little time, being desirous of amusing myself with my kite, and enjoying at the same time the pleasure of swimming, I returned, and loosing from the stake the string with the little stick which was fastened to it, went again into the water, where I found that, lying on my back, and holding the stick in my hand, I was drawn along the surface of the water in a very agreeable manner. Having then engaged another boy to carry my clothes round the pond, to a place which I pointed out to him, on the other side, I began to cross the pond with my kite, which carried me quite over without the least fatigue, and with the greatest pleasure imaginable. I was only obliged occasionally to halt a little in my course, and resist its progress, when it appeared that, by following too quick, I lowered the kite too much; by doing which occasionally I made it rise again. I have never since that time practised this singular mode of swimming, though I think it not impossible to cross in this manner from Dovor to Calais.

THE WHOLE ART OF

MAKING FIREWORKS.

This art, it is said, has been practised among the Chinese for many ages—with Europeans it is of comparatively modern date. The Italians and French are celebrated for the taste and splendour of their pyrotechnic exhibitions; and the displays we witness in this country show that, when circumstances call the art into exercise, we can form magnificent combinations and devices, in no respect inferior to those of our continental neighbours.

The prime materials of this art are, gunpowder, nitre, sulphur, and charcoal, along with filings of iron, steel, copper, zinc, and resin, camphor, lycopodium, &c. Gunpowder is used either in grain, half crushed, or finely ground, for different purposes. The longer the iron filings, the brighter red and white sparks they give; those being preferred which are made with a very coarse file, and quite free from rust. Steel filings and cast-iron borings contain carbon, and afford a more brilliant fire, with wavy radiations. Copper filings give a greenish tint flame; those of zinc, a fine blue colour; the sulphuret of antimony gives a less greenish blue than zinc, but with much smoke; amber affords a yellow fire, as well as colophony and common salt; but the last must be very dry. Lamp-black produces a very red colour with gunpowder, and a pink with nitre in excess. It serves for making golden showers. The yellow sand, or glistening mica, communicates to fireworks golden radiations. Verdigris imparts a pale

green; sulphate of copper and sal-ammoniac, a palm-tree green. Camphor yields a very white flame and aromatic fumes, which mask the bad smell of other substances. Benzoin, or Benjamin, and storax, are used also on account of their agreeable odour. Lycopodium burns with a rose colour and a magnificent flame; but it is principally employed in theatres to represent lightning, or to charge the torch of a fury.

OF SULPHUR OR BRIMSTONE.

Sulphur being one of the principal ingredients in gunpowder, and almost in all compositions of fireworks, great care ought to be taken to have it good. If it be of a high yellow, and, when held in the hand it crackles and bounces, it is fresh and good; but as the method of reducing brimstone to a powder is very troublesome, for small fireworks the sulphur may be bought in flour; taking care, of course, to get it at a good shop; but for the larger kinds, the lump brimstone, ground, is preferable.

OF CHARCOAL.

Charcoal is a preservative, by which the saltpetre and brimstone are made into gunpowder, by preventing the sulphur from suffocating the strong and windy exhalation of the nitre. Charcoal, for fireworks, must be soft and well burned. It may always be bought fit for use, and it is therefore only necessary to give this direction for selecting it.

OF SALTPETRE.

If this ingredient be not well cleansed from all impurities, and of a good sort, your works will not have their proper effect. To pulverize saltpetre, take a copper kettle, the bottom being spherical, and put into it fourteen pounds of refined saltpetre, with two quarts or five pints of clean water; then put the kettle on a slow fire, and when the saltpetre is dissolved, if any impurities arise, skim them off, and keep constantly stirring it with two large spatulas, till all the water exhales; when done enough, it will appear like white sand, and as fine as flour; but if it should boil too fast, take the kettle off the fire, and set it on some wet sand, which will prevent the nitre from sticking to the kettle. Be careful to keep it in a dry place.

OF GUNPOWDER, &c.

Gunpowder being the chief ingredient in fireworks, we give a short definition of its strange explosive force, and cause of action:—Each grain of gunpowder consisting of a certain proportion of sulphur, nitre, and coal, the coal presently takes fire, upon contact of the smallest spark; at which time both the sulphur and the nitre immediately melt, and, by means of the coal interposed between them, burst into flame; which, spreading from grain to grain, propagates the same effect almost instantaneously, whence the whole mass of powder comes to be fired; and as nitre contains a large proportion both of air and water, which are now violently rarified by the heat, a kind of fiery explosive blast is thus produced, wherein the nitre seems, by its aqueous and aereal parts, to act as bellows to the other inflammable bodies (sulphur and coal), to blow them into a flame, and carry off their whole substance in smoke and vapour.

How to meal Gunpowder, Brimstone, and Charcoal.—The mealing-table should be made of elm, with a rim round its edge, four or five inches high; at the narrow end a slider, running in a grove and forming part of the rim; so that, when you have taken out of the table as much powder as you conveniently can, with a copper shovel, you may sweep all clean out at the slider. Do not put too much on the table at once; but when you have put in a good proportion, take a muller and rub it therewith till all the grains are broken; sierce it in a lawn sieve, that has a receiver and top to it; and that which does not pass through the sieve, return again to the table, and grind it more, till you have brought it all fine enough to go through the sieve. Brimstone and charcoal are ground in the same manner as gunpowder, only the muller must be made of ebony, for these ingredients, being harder than powder, would stick in the grain of the elm, and be very difficult to grind; and as the brimstone is apt to stick and clog to the table, it would be best to keep one for that purpose only, by which means you will always have your brimstone clean and well ground.—We have, however, said that these articles can generally be procured at the shops in a sufficiently pure state for ordinary purposes, and we only give these directions for the benefit of those who are at a distance from respectable venders. The

pyrotechnic once stocked with proper ingredients, the first instruction he needs is—

To make Touch-paper.—Dissolve in some spirits of wine, or vinegar, a little saltpetre; take some purple or blue paper, wet it with the liquor, and when dry it will be fit for use. When you paste this paper on any of your works, take care that the paste does not touch that part which is to burn. The method of using this paper is, by cutting it into slips, long enough to go once round the mouth of the serpent, cracker, &c. When you paste on these slips, leave a little above the mouth of the case not pasted; then prime the case with meal-powder, and twist the paper to a point.

To make a Quick-Match.—Take some common cotton, such as is used for the wick of candles, and double it so that there may be 4 or 6 strands; boil it for some time in vinegar, and then, when sufficiently cold to handle, draw it through the hands, to squeeze out the greater part of the vinegar. This being done, rub over it some common thin paste, and afterwards some dry meal-powder, or draw it through the hand loaded with meal-powder; then sift some meal-powder over it, and let it dry. Make cases of long strips of paper, the longer the better, and cut about two inches wide; rolled on a wire and secured by the outer edge with paste, the quick-match drawn through this, when both are quite dry, forms the quick-match; several joints may be united by tying them together with thread, and tissue-papering the joints, taking care that the match of one touches the match of the other, or if a great length is required, the match need not be cut at all, but the various lengths of case slipped on by a wire or bodkin, and tied at the joints as before.

Portfires are small thin cases, 2½ inches long and about ¼ inch diameter, (sometimes much larger,) not choked, but merely turned in at one end, and the composition rammed in quite to the other end. They are used in pyrotechnic devices of various kinds, and also attached to long sticks to fire other works. Their composition may be, meal-powder, 1; sulphur, 2; nitre, 4; or meal-powder, 3; sulphur, 1; nitre, 3. These may be made without cases by rolling string or cotton well in either of the above compositions, damped with vinegar or

turpentine, though then a small quantity of gum tragacanth should be added. Many persons put a little of this gum to rocket-stars, and with good effect.

Crackers.—Cut some cartridge-paper into pieces 3½ inches broad, and 1 foot long; 1 edge of each fold down lengthwise about ¾ of an inch broad; then fold the double edge down ¼ of an inch, and turn the single edge back half over the double fold; then open it, and lay all along the channel which is formed by the folding of the paper some meal-powder; then fold it over and over till all the paper is doubled up, rubbing it down every turn; this done, bend it backwards and forwards, 2½ inches or thereabouts at a time, as often as the paper will allow; then hold all these folds flat and close, and with a small pinching cord give one turn round the middle of the cracker, and pinch it close; then bind it with pack-thread as tight as you can; then in the place where it was pinched, prime one end of it, and cap it with touch-paper. When these crackers are fired, they will give a report at every turn of the paper: if you would have a great number of bounces, you must cut the paper longer, or join them after they are made; but if they are made very long before they are pinched, you must have a piece of wood with a groove in it, deep enough to let in half the cracker: this will hold it straight while it is being pinched.

Marroons.—Formers for marroons are from ¾ of an inch to 1½ diameter. Cut the paper for the case twice the diameter of the former, broad, and long enough to go three times round; when you have rolled a case, paste down the edge, and tie one end close; then with the former drive it down to take away the wrinkles, and make it flat at bottom; then fill the case with corn powder, 1 diameter and ¼ high, and fold down the rest of the case tight on the powder. The marroon being thus made, wind packthread up in a ball, then unwind two or three yards of it, and that part which is near the ball make fast to a hook; then take a marroon, and stand as far from the hook as the packthread will reach; take some rope yarn and wind it lengthwise round the marroon as tight as you can, till it will hold no more that way; then turn it, and wind the packthread on the short way, then lengthwise again, and so on till

the paper is all covered; then make fast the end of the yarn, and beat down both ends of the marroon to bring it in shape. To consolidate the whole, dip it in hot glue in which red-lead has been mixed. The method of firing marroons is by making a hole at one end with an awl, and putting in a piece of quickmatch; then take a piece of paper, in which wrap up the marroon with 2 leaders, which must be put down to the vent, and the paper tied tight round them with small twine; these leaders are bent on each side, and their loose ends tied to other marroons: that is, whenever numbers are to be fired at once, otherwise a single leader is sufficient.

Pin-wheels.—First roll some paper pipes, about 14 inches long each: these pipes must not be made thick of paper, two or three rounds of elephant paper being sufficient. When your pipes are thoroughly dried, you must have a thin tube, twelve inches long, to fit easy into the pipes; at one end of this tube fix a small conical cup, which, when done, is called a funnel; then bend one end of the pipes, and put the funnel in at the other, as far as it will reach, and fill the cup with composition; then draw out the funnel by a little at a time, shaking it up and down; and it will fill the pipe as it comes out. Having filled some pipes, have made some small blocks, about one inch in diameter, and half an inch thick: around one of these blocks wind and paste a pipe, and to the end of this pipe join another; which must be done by twisting the end of one pipe to a point, and putting it into the end of the other, with a little paste; winding them one upon the other, so as to form a spiral line. Having wound on your pipes, paste two slips of paper across them, to hold them together; besides these slips of paper, the pipes must be pasted together.

There is another method of making these wheels called the French; which is, by winding on the pipes without paste, and sticking them together with sealing-wax at every half-turn; so that, when they are fired, the end will fall loose every time the fire passes the wax; by which means the circle of the fire will be considerably increased. The formers for these pipes are made from 1½ to 4-16ths of an inch in diameter, and the composition for them is as follows: meal powder,

8 oz., saltpetre, 2 oz., and sulphur, 1 oz.; among these ingredients may be mixed a little steel-filings, or the dust of cast iron. This composition should be very dry, and not made too fine, or it will stick in the funnel. These wheels may be fired on a large pin, and held in the hand with safety.

Serpents.—Serpents are generally made about five or six inches long, and about half an inch in diameter; they are sometimes made straight, and sometimes with a choke in the middle of them. The name which they bear probably arose from the hissing noise which they make when fired, or from the zigzag or vibrating directions in which they move when properly constructed. The cases must be made of some strong paper, and rolled in a form about one-fourth of an inch in diameter, or somewhat more, and having choked or tied one end up close with strong twine, fill the case about two-thirds of the way with the following composition: mealed-powder, 1 lb., saltpetre, 1¾ oz, charcoal, 1 oz.

To make Tourbillon Cases.—Those sorts of cases are generally made about 8 diameters long, but if very large, 7 will be sufficient; tourbillons will answer very well from 4 oz. to 2lb., but when larger, there is no certainty. The cases are best rolled wet with paste, and the last sheet must have a straight edge, so that the case may be all of a thickness: when you have rolled your cases, after the manner of wheel cases, pinch them at one end quite close; then, with the rammer, drive the ends down flat, and afterwards ram in to them about one-third of a diameter of dried clay. The diameter of the former for these cases must be the same as for sky-rockets.

Tourbillon.—Having filled some cases within about 1½ diameter, drive in a ladle-ful of clay; then pinch their ends close, and drive them down with a mallet; when done, find the centre of gravity of each case, where you nail and tie a stick, which should be one-third of an inch broad at the middle, and run a little narrower to the ends: these sticks must have their ends turned upwards, so that the cases may turn horizontally on their centres: at the opposite sides of the cases, at each end, bore a hole close to the clay with a gimblet, the size of the neck of a common case of the same nature from these holes

draw a line round the case, and at the under part of the case bore a hole, with the same gimblet, within half a diameter of each line, towards the centre; then from one hole to the other draw a right line. This line divide into three equal parts; bore two holes; then from these holes to the other two, lead a quick-match, over which paste a thin paper. When you fire tourbillons, lay them on a smooth table, with their sticks downward, and burn the leader through the middle with a port-fire. They should spin three or four seconds on the table before they rise, which is about the time the composition will be burning, from the side holes to those at bottom.

To tourbillons may be fixed reports, in this manner: in the centre of the case at top, make a small hole, and in the middle of the report make another; then place them together, and tie on the report, and with a single paper secure it from fire; this done, your tourbillon is completed. By this method you may fix on tourbillons, small cones of stars, rains, &c.; but be careful not to load them too much: an eighth of an inch will be enough for the thickness of the sticks, and their length should be equal to that of the cases.

Composition of Tourbillons —Fill with rocket composition of a strength proportionate to the size of the case.

Gerbes.—This is a species of firework, which, from a cylindrical case, throws up a luminous and sparkling jet of fire, to which, from its partial resemblance to a water-spout, the French have given the appellation of gerbe.

Gerbes consist of a strong cylindrical case, made of thick paper or pasteboard, and filled with brilliant composition, and sometimes with stars or balls placed at small distances, so that the composition and balls are introduced alternately; immediately below each ball is placed a little grained powder. This last kind of gerbe is more properly called Roman candles. Gerbes are sometimes made wholly cylindrical, and sometimes with a long narrow neck; the reasons for making them with a neck are deduced from rather philosophical considerations: when fired, they exert great force on all parts of the case, especially at the mouth, from which it proceeds with great velocity; the reasons, therefore, deduced for making them with a long neck, are—first,

that the particles of iron which enter into their composition will have more time to be heated, by meeting with greater resistance in getting out, than with a short neck, which would be burned too wide before the charge be consumed, and spoil the effect; secondly, that with long necks the stars will be thrown to a greater height, and will not fall before they are spent or spread too much; but, when made to perfection, will rise and spread in such a manner as to represent pretty exactly the form of a wheatsheaf.

The diameter of gerbes is generally estimated by the weight of a leaden ball which the case is capable of receiving: thus, we say, gerbes of eight ounces, of one pound, &c. Their length from the bottom to the top of the neck should be about six diameters, the neck being about one sixth of a diameter, wide and three-fourths of a diameter long. They are filled in two ways, according as they have a neck, or are wholly cylindrical; the cases of the latter kind are closed below, and are filled like those of serpents, but the composition must be put in by small quantities, and rammed very hard; cases with necks are filled from the bottom, but you must be careful, before you commence ramming, to plug up the aperture of the neck with a piece of wood fitted to its diameter; for, if this is not done, the composition will fall into the neck, and leave a vacancy in the case, which will cause it to burst as soon as the fire arrives at that part of it.

You must observe, too, that the first ramming or two be of some weaker composition than the body of the case. When filled, the plug must be removed, and the neck filled with some slow charge, and capped with touch-paper; a foot of wood is afterwards to be fixed to the gerbe and well secured, either by a cylinder fixed to the outside of the case, or by having in it a hole, into which the case may be inserted; when either of these methods is employed, the foot must be firmly attached.

Sometimes sparks are introduced during the filling of the cases, but in this event special care must be taken that they are not broken by hard ramming; their number should be regulated by the size of the case, and when carefully used, they produce a pleasing effect,

but they are most adapted to such gerbes as are wholly cylindrical.

The following method of finding the interior diameter of gerbes is generally employed: supposing the exterior diameter of the case at bottom, which is usually made somewhat larger than the top, to be four inches, then, by taking two-fourths for the sides of the case, there will remain two inches for the bore, which will be a tolerable good size, and from the rules given for the height the same will be about 24 inches to the top of the neck.

In ramming large gerbes an external mould will not be requisite, the cases being sufficiently strong to support themselves.

Small Gerbes.—They are frequently called white fountains; they differ but little, when used as gerbes, from the foregoing; they are made of four, eight, or twelve ounce cases, of any length, pasted and made very strong; before they are filled, drive in, about one diameter of their orifice high, some good stiff clay, and when the case is filled, bore through the centre of the clay to the composition a vent-hole of common proportion, which must be primed and capped as before.

These cases are sometimes filled with Chinese fire: in this case the clay must not be used, but filled the same as cylindrical cases, and footed and primed in the same manner. The composition fit for them is meal-powder, 1½lb.; iron sand, 5 oz.

Roman Candles.—Roman candles are constructed nearly after the manner of gerbes; their cases are made perfectly cylindrical, as above described, and between the layers of composition are interposed balls or stars, which are prepared as directed for rockets, but larger and rolled round by the fingers. In filling and ramming Roman candles, especial care must be taken that the stars are not broken in the operation. When the cases have been properly rolled and dried, and their bottoms firmly secured by tying them with some strong twine, it is best, previous to putting in the composition, to ram a little dry clay, which will fill up the hollow, and leave a better bottom to the case. This being properly done, put in a small quantity of corn-powder, and over this a small piece of paper, just to prevent the

composition from mixing with the powder; then as much of the composition is to be put in as will, when rammed hard down, fill the case about one sixth of its height: then over this a small piece of paper, (covering about two-thirds of the diameter,) as before; then a little corn-powder, and upon that a ball is to be placed, observing to let the ball be somewhat less than the diameter of the case. Over this first ball more of the composition is to be introduced, and pressed lightly down, till the case is about one-third full, when it may be rammed, but with some gentle strokes, lest the ball is broken by it; then a piece of paper, a little corn-powder, and upon it another ball, as before; so that the case after this manner will contain five or six balls with regular beds of composition between them, and have about the same length of composition above the highest ball. When the case is thus filled, it is to be capped with touch-paper by pasting it round the orifice, and a little priming of mealed powder being added, the piece is rendered complete.

In regard to the stars or balls, it is best that their form be flat and circular, or even square, rather than spherical, as they will be less liable to be injured in the filling; they should also be somewhat different in size, which is found to add much to their effect: that is, let the first star be about two-thirds the diameter of the case, let the next be a little larger, and so on increasing to the fourth, fifth, or sixth, which last should fit tight into the case.

Observe, also, to let the quantity of powder at the bottom of each ball increase as the balls increase in diameter, or as they come nearer the top of the case; not on account of the additional weight of the ball, but, as on those balls situate near the top, the force of the powder ceases to act on the ball, sooner than on those situate lower in the case; consequently, the force to throw the ball to the same distance must increase proportionably. Another reason for decreasing the quantity of powder towards the bottom is, that the same quantity used with the bottom as with the top ball, would cause the case to burst, and destroy all the effect which they are intended to produce.

The composition for filling is, mealed powder half a

pound, saltpetre two pounds and a half, sulphur half a pound, glass dust half a pound.

Pots des Brins.—These are large paper cylinders, filled with powder, stars, sparks, &c. They are generally made of pasteboard, and about four diameters long; they should be choked at one end like common cases. They are generally exhibited in numbers, fixed on a plank of some kind, in the following manner: on the under side of your plank, make as many grooves as you intend to have rows of pots; then at a little distance from each other, and exactly over the grooves, fix as many pegs, about three-fourths of one diameter high: then through the centre of each peg bore a hole down to the groove at the bottom, and on every peg fix and glue a pot, the mouth of which must fit tight on the peg; then through all the holes run a quick-match, one end of which must go into the pot, and the other into the groove, which must have a match laid in it from end to end, and covered with paper, so that when lighted at one end it may discharge the whole instantaneously. In each pot put about one ounce of mealed and corn powder; then put in some stars, and in others rain, and snakes, serpents, crackers, sparks, &c. When they are leaded, secure their mouths by putting paper over each.

When fired in considerable numbers, these pots des brins, from their affording so great a variety of fires produce a most pleasing exhibition.

Chinese Fountain.—Provide a dry piece of wood, about six or seven feet long, and about two and a half inches square; at the distance of sixteen inches from the top of this piece, (supposing it to be seven feet long and fixed perpendicularly,) must be fixed a shelf, sixteen inches long, and in width about two and a half inches, and in thickness about three quarters. Below this shelf must be fixed three or four other shelves of the same width and thickness, but in length increasing eight inches successively as they go towards the bottom. They must be fixed the same distance from each other as the first from the top.

Now, on the top of the post insert (into a hole of proper dimensions) a gerbe, or fire-pump; on the first shelf insert, after the same manner, two gerbes, on the

third four, on the fourth five, and on the bottom shelf six; they must be so placed, that the next above stand exactly over the intervals of those below. The gerbes should be placed so that their mouths incline a little forwards; if this be not done, the stars thrown out of the cases will strike against the shelf above, and produce but little of that effect, which, when properly arranged, renders them so beautiful.

A proper connection must be formed with your leaders between the different cases; beginning at the top, and carrying it downward to every one of them. The top one is to be lighted first.

Pyramids of Flowerpots or of Mines.—In general construction, this article is exactly similar to the one just described; but, in place of gerbes, or fire-pumps, it is loaded with mortars, filled with serpents, crackers, &c., and having in the centre of each a case filled with spur-fire. The mortars should be made of pasteboard, wound two or three times round a cylinder, about four inches diameter, and well secured by glue, by which means their bottoms and tops are fixed on them.

The spur-fire, which is the chief ornament of these pieces, is prepared as follows:—It has been said that excellence can never be obtained without overcoming commensurate difficulties: this is certainly verified in the preparation of this composition; for nothing can exceed the difficulty and trouble in preparing it, and nothing can exceed the beauty of its appearance *when prepared properly*. It is said to be the invention of the Chinese, and is certainly the most beautiful and curious of any known.

The proportion of the ingredients is saltpetre four pounds and a half, sulphur two pounds, and lamp-black one pound eight ounces. One great difficulty is in the mixing these ingredients together; it is best to sift the saltpetre and sulphur together first, and then put them into a marble mortar, and the lamp-black with them, which must be worked down by degrees with a wooden pestle, till all the ingredients appear of one colour, which will be somewhat grayish, but more inclined to black; when this is done, drive a little into a case for trial, and fire it in a dark place; if sparks come out in the form of *stars* or *spinks*, and in clusters spreading well

without any other sparks, it may be considered good: if it appear drossy, and the stars not full, it is not mixed enough; but if the pinks are very small, and soon break, it is indicative of an excess of rubbing; if the excess is great, it will be too fierce, and hardly show any stars; on the other hand, if the rubbing or mixture is in defect, it will be too weak, and produce nothing but an obscure or black smoke.

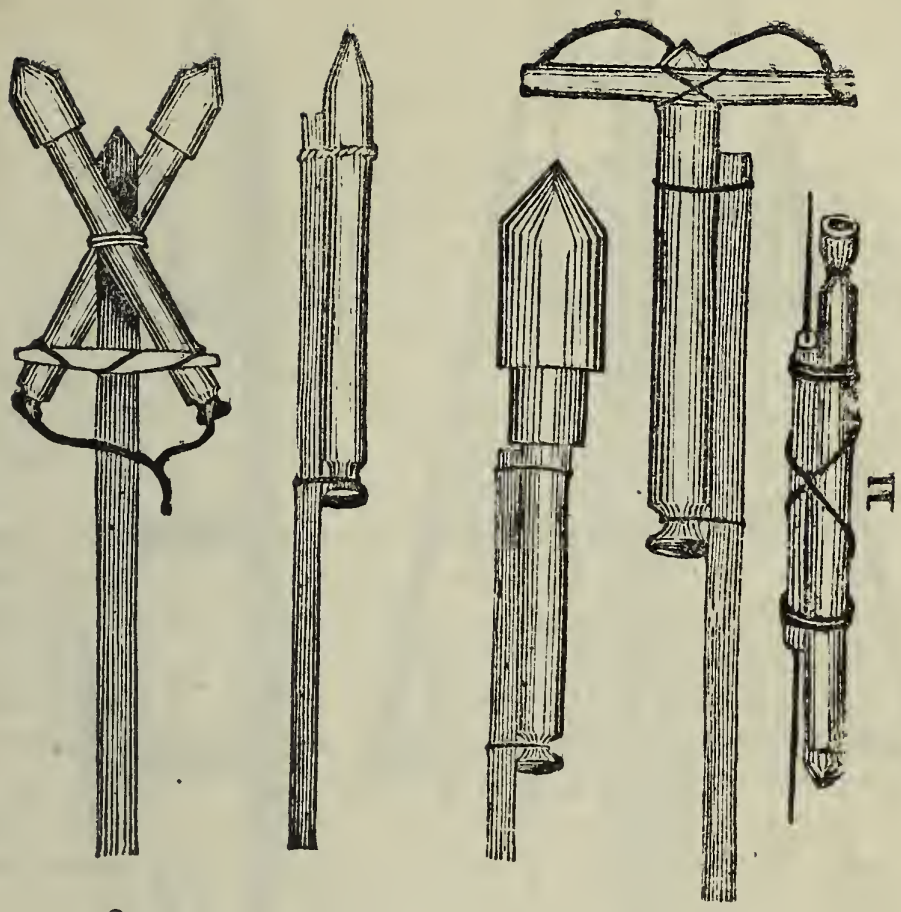
This composition is generally rammed in one or two ounce cases, about five or six inches long; care must be taken not to ram it too hard. The aperture at the choke should not be so wide as is usually given to other choked cases.

It is somewhat remarkable, that the composition should be improved by being kept in the cases; but it is found that they always play better, if suffered to stand a time after they are filled.

In preparing the pyramid of flower-pots, the cases of spur fire are to be placed in the middle of the mortars, and be connected by leaders, so that they may all be fired together. The cases will first play off in a very pretty manner; and when exhausted, the fire from them communicates to the powder at the bottom of the mortars, and this suddenly taking fire, all blow up simultaneously, and scatter their luminous fragments in the air: the serpents hiss, the crackers bounce, and the illuminated stars fly in all directions, forming an excellent conclusion to a small exhibition.

This beautiful composition is also susceptible of other representations, many of which may, without the least danger, be exhibited in a room, as well as in the open air: it is really of so innocent a nature, that it may be (though improperly) called a *cold fire;* for it is found that, when well made, the sparks will not burn a handkerchief when held in the midst of them; they may be held in the hand with perfect safety; if the sparks fall a short distance upon the hand, you feel them like drops of rain.

A pretty exhibition may be produced by placing a number of spur-fires round a transparent pyramid of paper, and firing them in a room, or in the open air. In all cases, and in every variety of exhibition, this fire is very beautiful, and will always repay the labour of preparation.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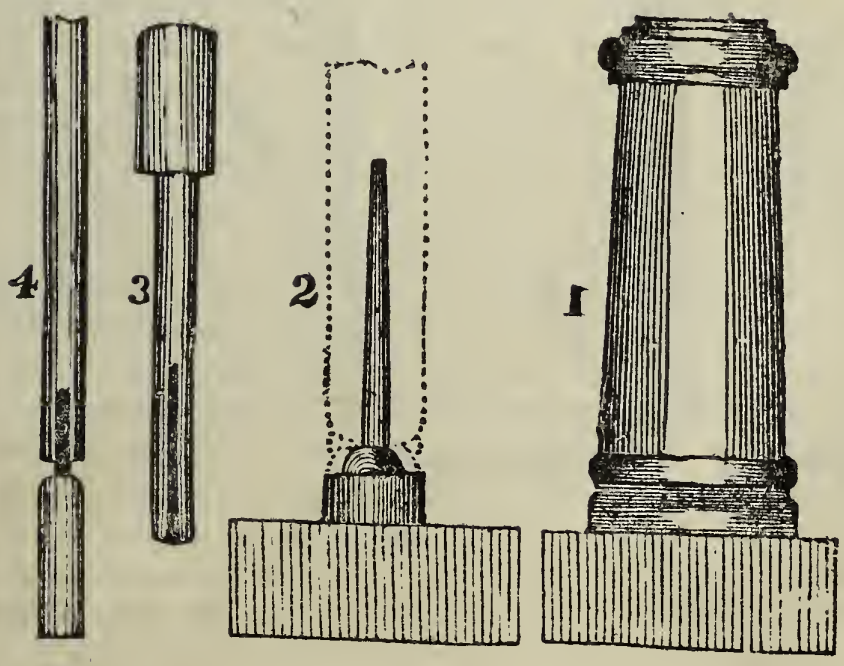
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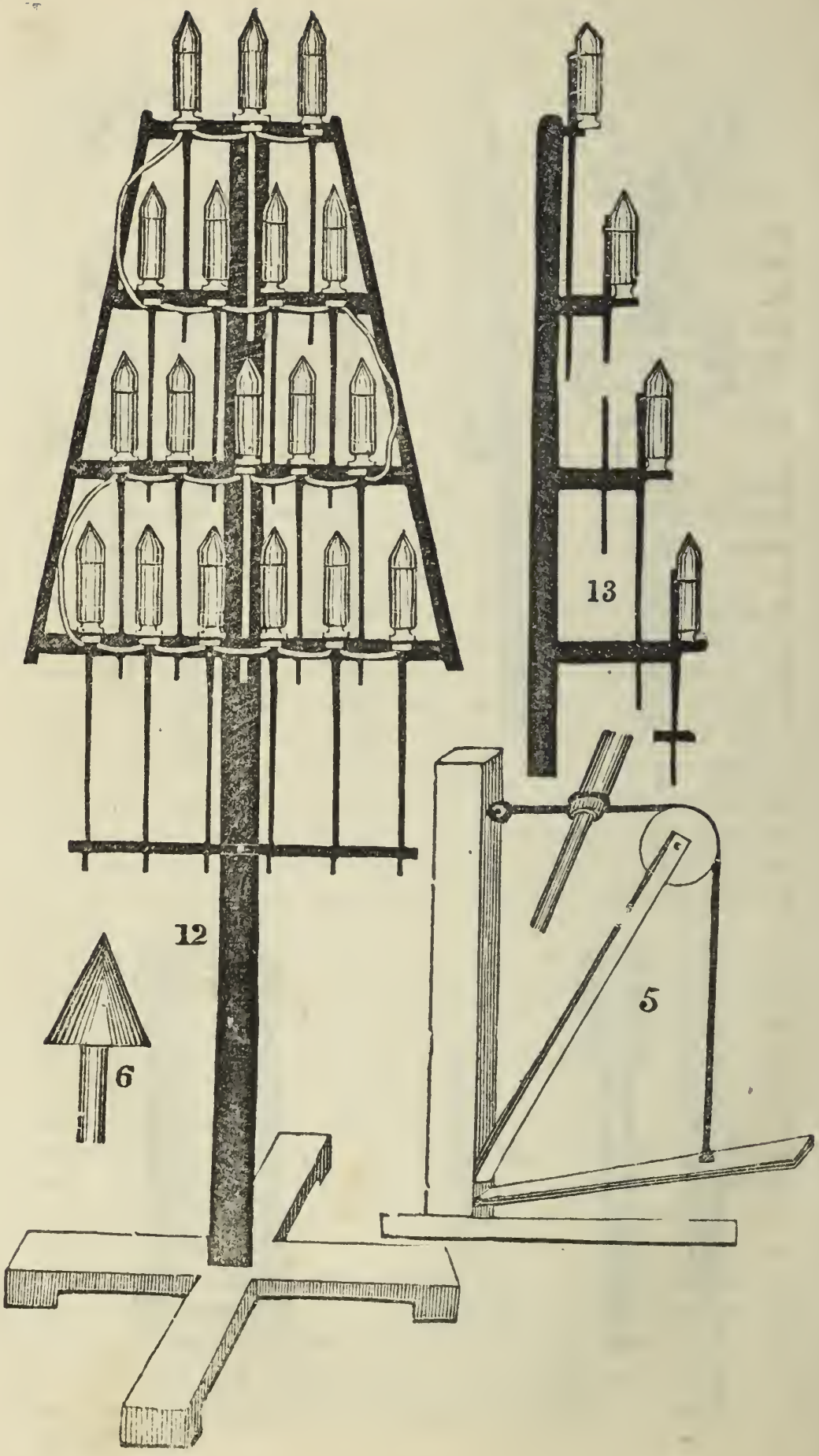
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ROCKETS.

Of all fireworks, rockets are amongst the most noble and effective. The ingredients for these, the apparatus employed, and the detail of the manufacture of them, may be considered the foundation of all artificial fireworks; and to make them well, involves the same principles, and requires the same caution, as in making all others.

Size of Rockets.—The size of rockets is indicated by ounces or pounds: thus, we say an eight ounce rocket, a pound rocket, and so on; by this expression it is not meant that the rockets weigh so much as their name indicates, but that the bore or cavity of them will just suffer a leaden bullet of that weight to pass down them. For example, a pound rocket will admit a leaden bullet that weighs a pound. Rockets may be made of any size, from one ounce up to fifty or more pounds. Those for amusement are usually one pound or under—the larger kinds are employed for military purposes only.

Forming the Cases or Cartridges.—These may be made of any kind of stiff thick paper, either cartridge paper, or what is equally as good, and much cheaper, namely, common *bag-cap* paper. To roll up the cases, you must have a smooth round roller, or as it is called a *former*, exactly the size of the cavity of the rocket, and ten or twelve times as long. Then lay a sheet of the paper upon a table or board, and paste four or five inches along the end of it, leaving the rest of the sheet of paper without paste; then roll it smoothly over the former, dry end first, until the whole is rolled up, when, of course, the paste will stick, and a thin case be formed. Keep rolling it along the table with the hands, in the same way as a rolling-pin is used, for two or three minutes, until the various folds of the paper set close and tight to each other; then put on another sheet in the same way, and so on until the case is thick enough, and this is known by the measurement across it. If the *former*, without the case, measure five parts—when the case is upon it, they must measure together eight parts. That is, the paper must be rolled on until it forms a case, the thickness of the sides of which are a trifle more than one-third of the thickness of the *former*. The length of

the rocket-case, and, consequently, the width, that the sheets of brown paper are to be cut before pasting, varies with the size of the rocket—in small rockets the length of the case may be six times; the diameter in larger rockets four or five times is sufficient.

When the case has been made so far, it is to be *choked* while yet damp: that is, to be contracted in diameter near one end; and for this purpose a little simple contrivance is requisite, called a *choking-cord*; and also the former is made with a hole drilled at one end, and a second joint made to fit on by means of a wire projecting at one end of it, and which fits into the hole of the *former* (Fig. 4). To choke the case, draw the *former* partly out until you can see about an inch of the inner cavity of the case; then put on the second joint (the wire of it going into the hole of the *former*), and pass this on until its end is about half an inch within the case, aud consequently leaving a space of about half an inch between the two joints occupied by the wire alone. Then going to an apparatus, similar to that figured in No. 5, turn the cord once round the case where the cavity is, put the foot upon the treadle, which tightens the cord, and squeezes the paper case at the point required; and that it may squeeze it equally and neatly on all sides, the case should be held in the hands and moved up and down upon the cord, until the operator sees that it is sufficiently and properly compressed. Let it be observed, that although the choking apparatus used by the firework-maker is represented as above alluded to, yet to the amateur it is by no means necessary. What will do quite as well, is a thin cord fastened at one end to a staple in the wall, and by the other tied round the waist of the operator; as he may lean back, of course the cord would be tightened, and the desired purpose accomplished. When the case is sufficiently compressed, it is to be tied with two or three turns of strong string. The case is now complete, except that the part of it where it is choked is perhaps rather rough and uneven inside: this must be compressed down, for much of the effect of the rocket will depend upon the perfect regularity of this part, as it is through the hole left by the wire in the middle of the choke that the fire is afterwards to issue. To compress

this part properly a mould is necessary—this important apparatus may be described as follows:—

The Rocket Mould is represented in Fig. 1. It consists of a solid foot of wood; upon the centre of this stands a short cylinder about half an inch high, and exactly the size of the mould, to be placed over it, as afterwards described; this short cylinder has a shoulder above, and terminates in a round top. Out of the middle of the top is a tapering thick brass wire, projecting some inches upwards, as is seen in Fig. 2. The whole is so arranged, that when one of the newly made cases is put upon the wire and forced down, the wire fills up the choke-hole, the round top fits into the small part of the case below the choke, the shoulder of the cylinder bears the extreme end of the case, and the short cylinder agrees in size with the outside of the case. There fits over this (case and all) a strong wooden or metal tube; so that it is seen that there is no cavity anywhere, except the inside of the rocket case, and even in this a thick wire runs up to nearly the top of that part of the case, where the composition is rammed, or nearly two-thirds of the whole case from the choke upwards. The wire above mentioned is called the *piercer*. All rockets must be placed in the mould to be filled, as well as to smooth and consolidate the part choked. With the mould are used *rammers*, (Fig. 3) formed of hard wood, of the shape of a popgun stick, the size of them rather less than the diameter or the cavity, and having a hole bored up their centre, in order to admit the piercer. It is evident that there must be a complete mould, piercer, and one or more rammers, for every sized rocket.

But to proceed with the manufacture: When the case has been tied with string, put it in the mould and the rammer down into it, and give this, the latter, a blow or two with a mallet, which driving it down while yet damp with the paste, will render the whole compact and smooth; and the case being taken out, may be placed in an oven, or near the fire to dry. If it be desired to ornament it in any way, or cover it with white paper, it is evident that this must be done before choking.

Charging the Roc et.—The next process after drying the cases is to charge them with the requisite compo-

sition. This is done very easily. Put the cases in the mould, with the piercer in it, and put enough composition to fill about one inch of the case; then taking the rammer, ram it down with three or four strong blows with a wooden mallet. Then put in the same quantity of composition again, and ram that down in the same manner, and so on till the case is filled to the top of the piercer, and one diameter above it. Then separate some of the central folds of the paper, which, it has been observed, is not parted, and turn them down upon the composition, ramming them down hard upon it, or what will do as well, put in a piece of paper as wadding. When this is rammed down, and firm, bore with a *brass* bradawl three or four holes through it; these holes serve to make the requisite communication between the two parts of the rocket. (It ought always to be borne in mind, that iron tools must never be used in making fireworks of any kind, as they are liable to throw out sparks when striking against a hard stoney substance; besides which, the sulphur used would soon combine with the iron, and render it brittle. Brass may be used, but still better copper tools) The rocket is now rammed, and may be taken out of the mould, set aside, and another rammed in like manner.

Loading Rockets—The cavity left at the top of the rocket is now to be filled. If the rocket be small, a charge of a half an ounce of gunpowder is put in it, and the end fastened up; or, in larger rockets, stars or fiery rains are placed in the cavity, with a little loose gunpowder sprinkled over them, and the end fastened down, either by turning down some more of the paper of the case, or in any other convenient manner: there should now be placed upon the top of the whole a conical cap, which, by cleaving the air, assists the rocket in rising into it.

Priming Rockets.—The rocket is now supposed to be closed at one end. It only requires to be primed at the other, and that, it will be observed, is the end which was choked, and which is still open, and has a hole passing up it which the *piercer* occupied. To prime it, fill up the hole with loose gunpowder, and paste a piece of touch-paper over it.

Rocket Sticks.—Next fasten the stick to the rocket by

2 strings, as is seen in any of the Figures: the sticks being previously prepared of proper length and size, as follows. The smaller ones are easily and best made of those laths, called by bricklayers double laths, and the larger one pantile laths, but any slip of dry deal will answer the purpose.

2lb rockets require sticks 9 feet 4 inches long. 1 inch square at top, and rather more than half an inch square at bottom.

1lb rocket sticks are 8 feet 2 inches long, $\frac{3}{4}$ inch square at top, and $\frac{2}{3}$ at bottom.

8 oz. rocket sticks are 6 feet 2 inches long, $\frac{3}{4}$ inch square at top, and $\frac{2}{3}$ at bottom.

4 oz, rocket sticks, 5 feet 3 inches long: $\frac{1}{4}$ by $\frac{1}{2}$ inch at top, and $\frac{1}{4}$ inch square at bottom.

2 oz. rocket sticks are 5 feet 1 inch long, 3 tenths by $\frac{1}{2}$ inch at top, 2-tenths of an inch at bottom.

1 oz. rocket sticks, 3 feet 6 inches long, and so on for others of various sizes. The weight and the length o. the stick must be such as, when tied on the rocket, shall balance on the finger, at a point about an inch from the point choked.

Rockets with small heads, and such as are not charged with a report, and also small signal rockets, do not require sticks so heavy as the above; so also petard rockets and others with large heavy heads require them still longer. The beauty, steadiness, and lofty flight of a rocket depends much upon the right adjustment of the stick. If this be too heavy, the rocket will move slowly, and not ascend to a sufficient height: if too light, its course will be unsteady and irregular, so that the majesty of it will be lost. When the sticks have been planed of proper dimensions, there should be a channel cut on one side near the top of the sticks, to admit the rocket, and two notches to tie it on with; one round the choke, the other near the top of the stick, which should always nearly touch the head of the rocket.

Composition for filling Rockets.—It is an axiom among fire-work makers, that the smaller the case, so much *quicker* must be the composition to fill it, or in other words, the mixture that will do for a small case will burn too rapidly when placed in one of larger cavity.

Hence it follows, that the same composision will not do for large and also for small rockets. The following are some of the most approved receipts :—

To combine the ingredients of all fireworks well together they should be first pounded separately. Gunpowder when pounded is called *mealpowder*, and since, as already stated, it may be bought in this state, it is better to use it, as it saves much trouble. When ponnded separately, mix them well together by hand, and rub them through a very fine wire sieve, or in absenee of this, a common sieve.

For Rockets of 1 *or* 2 *lbs.*—Meal-powder, 2lbs ; saltpetre, 8oz.; brimstone, 4 oz.; charcoal, 2 oz.; steel-filings, 1½ oz.

For Rockets of from 1*lb. to* 4or.—Meal powder, 1 lb.; saltpetre, 4 oz.; brimstone, 3 oz.; charcoal, 1½ oz.

For Rockets under 8*oz.*—Meal-powder, 1 lb. 4oz.; saltpetre, 4 oz: charcoal, 2 oz.

The above is the usual form of the common small rocket. Before we proceed to describe the loading of the heads of the rockets with stars, fiery rain, &c., it may be advisable to offer a hint or two further, particularly to enable the amateur to ascertain the certainty of his success before his rockets may be finished, or he may have an opportunity of letting one off. This success will depend chiefly upon the degree of union, or the perfect blending of the various ingredients. We advise that they should, after having been pounded, be mixed together by the hand:—let not the maker soon get tired of this work of rubbing them together on the board, for much depends upon it, and it would be even better if the powders were incorporated on a board with a roller or muller rubbed upon them. When the ingredients are sufficiently blended may be known thus: take a sieve and sift a little of the composition along a board (this should be done in the open air,) so that it hardly covers the board; then set fire to it at one end. if it burn gradually and quietly along to the other end, it is ground enough, but if it burns with little *phits* and starts, it must be mixed more intimately. If the rockets be finished before this has been tried, letting off one will ascertain the same fact; because, if not well mixed, the rocket will *smoke*, and this must never be the case

under any circumstances. It has been already observed, that every rocket should be terminated by a conical cap of paper. This cap is made of a circle of paper about three inches' diameter, and cut with a slit reaching from the circumference to the centre, when it may be folded of any sized cone required, and, by using a little paste to the edges, it will be rendered sufficiently solid. A piece of wood shaped like Fig. 6, is usually employed to form the conical cap upon, but this is not by any means necessary.

Rockets, of whatever kind they may be, are exactly similar to each other as to their compositions, their cases, and the manner of ramming. They vary, however, in other respects, and consequently have assigned to them different names, according to this variation, or according to the devices which they produce or emit; as follows:

Headed or Petard Rockets.—The top of a common small rocket is not sufficiently large to hold those beautiful stars and fiery rains, which occasion so much delight. To have these appendages, therefore, the rocket should be at least of half a pound size; and, instead of the upper part of the case being the only receptacle of any furniture, as it is called, it may have a paper box attached to it of a larger size than the case itself, as is represented in Fig. 8. It may be made in the same way as the case itself, but slight in substance, and connected with the case by a rim of wood or thick pasteboard, such as the cover of a book, cut round to fit the head, and with a hole in it to fit the case, the whole neatly pasted together with strips of paper; or else this new case for the head may be choked on to a case at once, and tied there.

Rocket Stars, Common.—Nitre, 1lb.; sulphur, 4½ oz.; antimony, 4 oz.; isinglass, ½ oz.; camphor, ½ oz.: spirits of wine, ¾ oz.

White.—Mealed powder, 4 oz.; saltpetre, 12 oz.; sulphur, 6½ oz.; camphor, 5 oz.; or else, meal-powder, 4 oz.; nitre, 16 oz.; sulphur, 7 oz.; or meal-powder, 3 oz.; nitre, 16 oz.; sulphur, 8 oz.

Blue.—Meal-powder, 8; nitre, 4; sulphur, 2½ o .

Amber.—Nitre, 8; sulphur, 2; yellow amber, 1; sulphuret of antimony, 1; and meal-powder, 3 oz.

Crimson.—Sulphur, 1; sulphuret of antimony, 1; chlorate of potass, 1; nitrate of strontian, 5 oz.

Green.—Chlorate of potass, 5; sulphuret of antimony, 4; sulphur, 13; nitrate of barytes, 80 parts.

Purple.—Lamp black, 1; realgar, or red arsenic, 1; nitre, 1; sulphur, 2; nitrate of Strontian, 16 parts; chlorate of potass, 5.

Tailed.—Nitre, 4; sulphur, 6; sulphuret of antimony, 2; rosin, 4 parts.

Tailed with Sparks.—Meal-powder, 1; nitre, 1; camphor, 2 oz.

To make the stars, it is requisite to mix and incorporate the compositions well together, those containing the chlorate of potass with the hand only, (because if ground such may explode,)—and form the composition into a paste with spirits of wine, brandy, or vinegar, so that it shall resemble dough in stiffness; then cut it into pieces about the size of small marbles, roll them round in the hand, dust them over with meal-powder, and set them aside to dry. To charge the rocket, 20 or more may be placed in the head of the rocket, and a dram full of grained gunpowder being sprinkled between them, the top is to be closed by the conical cap, and the rocket will be finished; and, provided the gunpowder has free communication with the charging composition, it will explode when the rocket has reached its proper altitude.

Fiery Rains are often used instead of stars, and with a fine effect: they are made by substituting small cases, like squibs, for the stars. The cases may be made by rolling a few inches of paper round a pencil, and turning in the lower end—ramming it down on the table or otherwise. When dry, these cases, which may be from 2 to 3 inches long, are to be rammed with either of the following compositions, and primed with a little damp powder, and a piece of touch-paper slightly pasted over it—taking care that the paste never touches the part of the paper which is to burn. When ready, they are to be placed in the head of the rocket with the mouth downwards, and gunpowder strewed among them, as among the stars.

Gold Rain.—Sawdust, 1; sulphur, 2; meal-powder, 2; glass dust, 8; nitre, 8 oz. Or, meal-powder, 4

nitre, 16; sulphur, 4; brass dust, 1; sawdust, 2¼ oz.; glass dust, 6 drachms. Or, meal-powder, 6; nitre, 1; charcoal, 2 oz.

Silver Rain.—Meal-powder, 2; nitre, 4; sulphur, 2; sulphurate of antimony, 2; Sal-prunella, ½ an oz. Or, nitre, ½; sulphur, 2; charcoal, 4 oz.

Note—Any of the compositions for stars may be used in cases to form rains of different colours—they must not be rammed very hard.

Shower Rockets are such as are charged with a composition which, at the bursting of the rocket, disperses itself in a fiery shower. The heads of the rockets are filled loosely with either of the following compositions, of which the first and the last are best.

Chinese Fire.—Meal-powder, 1lb.; sulphur, 2; sulphuret of iron, 2 oz. (Made by throwing iron filings into melted sulphu, stirring them about, and when cold, powdering and sifting them.)

Ancient Fire.—Meal-powder, 1lb.; charcoal, 2 oz.

Brilliant.—Meal-powder, 1lb.; sulphuret of iron, 4 oz.

Red Shower.—Take deal sawdust and boil it in water in which saltpetre has been dissolved. Take it out, and when dry, spread it out on a table, and sprinkle it with equal parts of meal-powder and sulphur.

Sometimes one rocket is tied to the top of another, when it is called a *towering* rocket; in this case there must only be half a diameter of composition rammed above the piercer of the lower rocket, and a piece of quick match fastened on this, which will communicate the fire to the upper rocket when it is burned out of the lower one, carrying it still higher; and a great improvement is made if the lower case be fastened on with the quick match, so that it shall be thrown off as soon as the upper composition burns, as it will thereby be freed from the weight of the empty case.

The Caduceus Rocket, which is represented in Fig. 9, consists of two rockets fastened on the same stick, which their ends are kept apart by a cross slip of wood. They are fired by a quick match inserted in the end of each, and when ascending, describe a most beautiful screw of fire.

Honorary Rockets are such as are without a head of

stars, rain, &c.; but, instead of this, have a small case filled with a strong composition—the case should be about 2 ounces in the bore, and 5 or 6 inches long—when charged, stop up the two ends tightly, either with corks, plugs of wood, clay, or by turning over the ends of the case, and keeping either tight by paper pasted over them. Then drill two holes, one on each side, near the ends, and connect these holes with a quick-match to the top of the rammed composition; the case being first tied tightly on.

When fired, the rocket in its ascent will present nothing peculiar; but, in descending, the fire having by that time inflamed the composition in the upper case, and the holes of this being sideways, the case will revolve on its axis—and thus a beautiful screw of fire will be produced. This case may be made very easily to act when the rocket is yet ascending, if such be thought advisable.

Scroll Rocket.—The principle of boring the case with two holes, one on each side, will show the manner of making that beautiful kind, called the Scroll Rocket: it is made precisely as others, but headed with little cases filled with a quick composition—of meal-powder, 4; sulphur, 1; and charcoal, 1 part; closed at both ends, but pierced with the two contrary holes, and these being connected with a quick match, to insure their lighting properly. When fired, each of the little cases whirls round an imaginary axis, producing a most brilliant appearance of so many scrolls of vivid fire.

Line Rocket—is merely a common rocket without a bang or report, being tied to a hollow tube of tin or wood, such as a popgun (seen in Fig. 11.) It is to be suspended by putting a cord through the tube, and firing it at one end of the line, when it will shoot along to the other with amazing rapidity; when here, if there has been a second case attached to it with the mouth in the contrary direction, and a leader to it, the rocket will rush back again with equal force, and so on backwards and forwards as long as there are fresh cases to ignite, and the more rapidly each time, because of the whole machine being lighter as the cases burn empty.

To Fire Rockets.—Nothing is more easy than to fire

a rocket. All that is requisite is to place it quite perpendicular, the case of it resting on two nails, and the stick of it between two others or in a staple—apply fire to the lower end with a portfire sticking on a sharp point at the end of a stick, when the rocket will immediately ascend. If a flight of many rockets is to be sent off at once, a frame-work may be made as represented in Fig. 12, and sideways, in Fig. 13, the various rockets being connected together with a quick-match, that all may ascend at once.

TO MAKE VARIOUS COLOURED FIRES.

Red.—Dry nitrate of strontian, 1½ oz.; sulphur, 3 drachms and 6 grains; oxymuriate of potash, 1 drachm, and 12 grains; sulphuret of antimony, 2 drachms; charcoal, 1 scruple: or, nitrate of strontian, 1 oz.; chlorate of potass, 3 dwts.; meal-powder, 3 dwts. Mix together carefully, and, upon being inflamed, the red colour will be very intense.

The oxymuriate must be powdered by itself, and mixed with the other ingredients carefully on paper; otherwise it will explode, to the imminent danger of the operator. When thoroughly mixed, lay it on a tin plate, and set fire to it, when it will burst into a splendid red flame.

Blue.—Nitrate of barytes, 77 parts by weight; sulphur, 13 ditto; chlorate of potass, 5 ditto; reatgar, 2 ditto; charcoal, 3 ditto. Mix and inflame as for red fire. This mixture is not the blue light used among shipping and in terminating theatrical scenes, but the more delicate flame used in fairy and apparition scenes, &c., and which casts a peculiar soft whitish blue light, accompanied by much white smoke.

Purple.—Reduce each of the following ingredients separately to a fine powder; mix them by stirring carefully; and rub them through a hair sieve. The mixture will, when made into rocket stars, and inflamed, burn with a fine purple light: chlorate of potash, 2 oz.; black oxyde of copper, 1 oz.; sulphur, 1 oz.

Green.—Mix, as above directed, the following ingredients; which, when burned, produce a green flame:—Dry nitrate of barytes, 1½lb.; chlorate of potash, 4 oz.; relagar, or still better, metallic arsenic, 2 oz; charcoal, 1½ oz.; sulphur, 8 oz.

CRICKET.

THIS noble and athletic pastime may be styled truly English, for by none but the English and their descendants do we believe it to be practised. In England, indeed, with the exception of two or three counties, its popularity is universal, confined to no class, but alike estimated by the peasant and the peer. In the metropolis and in the adjacent counties, it may be said to be, almost exclusively, the national sport. Lord's and other spacious grounds are dedicated exclusively to its practice; and the being a first-rate cricketer is, even amongst the nobility of the land, looked upon as a distinction honourable to the manly character.

Cricket is always played on a green or meadow, the more level and spacious the better. There are two games—*Single* and *Double Wicket.* The latter is the game more generally played. *Single Wicket* is usually played with from four to six persons on either side; *Double Wicket*

with eleven; but in both the number may be varied according to the number of players in the field. A either game can only be acquired by practice, as rules vary in different localities, and as a competent knowledge of the respective rules is sure to be attained during the requisite practice, we shall not go into them in detail; but, after explaining the terms used by players, and giving a few general directions, close this chapter with the code of laws last adopted at Lord's celebrated cricket-grounds, at Marylebone; and which we recommend our readers to act upon, as far as circumstances may permit. With respect to

Bats, *Balls*, and *Wickets*, the sizes and weights prescribed at Lord's are to be understood as adapted for men, and boys must of course be allowed to use lighter ones, bearing in mind that the relative proportions should be strictly maintained, not only with regard to the bats and balls, but also to the distances between the stumps and wickets, &c. The chief agent in the game is

The Striker, or *Batsman*.—His duty is obvious from his title; as is that of

The Bowler.—The mode of bowling generally adopted is to hold the ball with the seam across, so that the tips of the fingers may touch; it should be just sufficiently grasped to keep it steady. The ball should be delivered with one foot behind the bowling-crease and within the return-crease. The bowler must throw the ball in such a way that the striker can play at it, for if it should go over his head or out of bounds, the party in will be entitled to one notch, to be put down to the byes. Also, the bowler is not allowed to deliver the ball with the arm extended straight from the body, or with the back part of the hand uppermost.

The Wicket-Keeper's business is to watch the striker, and if he moves from the ground, to knock down his wicket, which is called Stumping Out.

The First Short Slip stands about two feet from the wicket-keeper, and takes his place in case of his leaving it for any purpose.

The Point is placed on the popping-crease, about seven yards from the striker. He is to take care not to trench on the room allotted to Short-Slip.

Leg, or *Hip*, stands a little further back than the straight line of the popping-crease.

Long Stop is placed at a distance behind the wicket, to save a run, in the case of the ball not being stopped by the striker or wicket keeper.

Long Slip stands about the same distance from the wicket as the long stop, in a line with the striker, so as to cover the short-slip. Another player may be placed on the off-side, so as to be ready to receive the ball in case of its being missed by the middle wicket-man.

Long Field is placed on either side, at some distance from the bowler's wicket, so as to cover him, and in case of his missing the ball, thus to save a second run; and if there be more players, they may be placed so as to back up or assist any of those already specified.

An *Umpire* is generally chosen, whose business is to look vigilantly on, and see that all the play is conducted according to the laws.

THE LAWS OF CRICKET,

AS REVISED BY THE MARYLEBONE CLUB.

THE BALL

1. must weigh not less than five ounces and a half, nor more than five ounces and three quarters. It must measure not less than nine inches, nor more than nine inches and one quarter, in circumference. At the beginning of each innings either party may call for a new ball.

THE BAT

2. must not exceed four inches and one quarter in the widest part; it must not be more than thirty-eight inches in length.

THE STUMPS

3. must be three in number; twenty-seven inches out of the ground; the bails eight inches in length; the

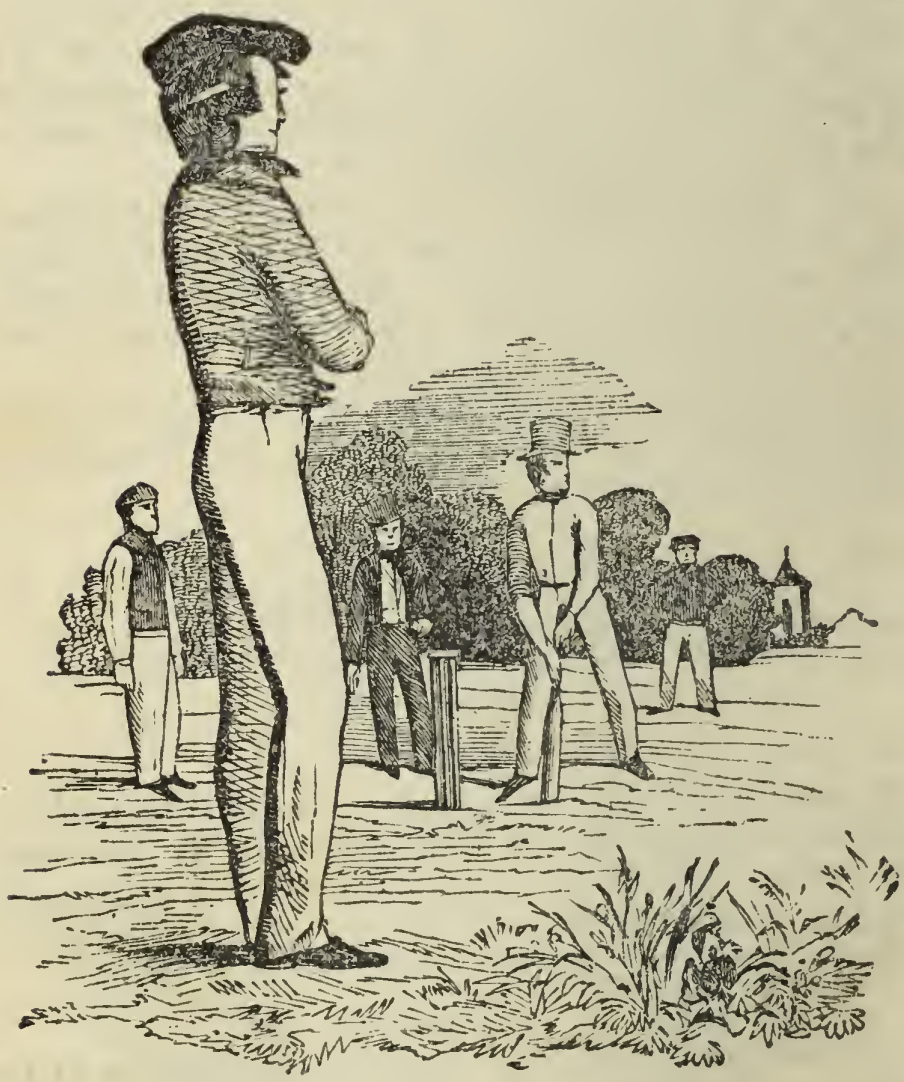
stumps of equal and of sufficient thickness to prevent the ball from passing through.

THE BOWLING-CREASE

4. must be in a line with the stumps; six feet eight inches in length; the stumps in the centre; with a return crease at each end towards the bowler at right angles.

THE POPPING-CREASE

5. must be four feet from the wicket, and parallel to it; unlimited in length, but not shorter than the bowling-crease.



THE WICKETS

6. must be pitched opposite to each other by the umpires, at the distance of twenty-two yards.

7. It shall not be lawful for either party, during a

match, without the consent of the other, to alter the ground by rolling, watering, covering, mowing, or beating. This rule is not meant to prevent the striker from beating the ground with his bat near to the spot where he stands during the innings, nor to prevent the bowler from filling up holes with sawdust, &c. when the ground shall be wet.

8. After rain, the wickets may be changed with the consent of both parties.

THE BOWLER

9. Shall deliver the ball with one foot on the ground behind the bowling-crease, and within the return-crease, and shall bowl four bowls before he change wickets; which he shall be permitted to do once only in the same innings.

10. The ball must be bowled;—If it be thrown or jerked, or if the hand be above the shoulder in the delivery, the umpire must call 'No Ball.'

11. He may require the striker at the wicket from which he is bowling, to stand on that side of it which he may direct.

12. If the bowler toss the ball over the striker's head, or bowl it so wide that it shall be out of distance to be played at, the umpire (even although he attempt to hit it) shall adjudge one run to the parties receiving the innings, either with or without an appeal from them; which shall be put down to the score of wide balls; and such ball shall not be reckoned as any of the four balls.

13. When the umpire shall have called 'Wide Ball,' one run only shall be reckoned, and the ball shall be considered dead.

14. If the bowler deliver a 'No ball,' the striker may play at it, and be allowed as many runs as he can get, and he shall not be put out, except by running out. In the event of no run being obtained by any other means, then one run shall be scored.

15. At the beginning of each innings, the umpire shall call 'Play;' from that time to the end of each innings, no trial ball shall be allowed to any bowler.

THE STRIKER IS OUT

16. If either of the balls be bowled off, or if a stump be bowled out of the ground.

17. Or, if the ball, from a stroke of the bat, or hand, but not wrist, be held before it touch the ground, although it be hugged on to the body of the catcher.

18. Or, if in striking, or at any other time while the ball shall be in play, both his feet be over the popping-crease, and his wicket put down, except his bat be grounded within it.

19. Or, if in striking at the ball he hit down his wicket.

20. Or, if, under pretence of running, or otherwise, either of the strikers prevent a ball from being caught, the striker of the ball is out.

21. Or, if the ball be struck and he wilfully strike it again

22. Or, if in running the wicket be struck down by a throw, or by the hand or arm (with the ball in hand), before his bat (in hand) or some part of his person be grounded over the popping-crease. But if both the balls be off, a stump must be struck out of the ground.

23. Or, if any part of the striker's dress knock down the wicket.

24. Or, if the striker touch, or take up the ball while in play, unless at the request of the opposite party.

25. Or, if with any part of his person he stop the ball, which in the opinion of the umpire at the bowler's wicket shall have been pitched in a straight line from it to the striker's wicket, and would have hit it.

26. If the players have crossed each other, he that runs for the wicket which is put down is out.

27. A ball being caught, no run shall be reckoned.

28. A striker being run out, that run which he and his partner were attempting shall not be reckoned.

29. If a lost ball be called, the striker shall be allowed six runs; but if more than six shall have been run before the lost ball shall have been called, then the striker shall have all which have been run.

30. After the ball shall have been finally settled in the wicket-keeper's or bowler's hand, it shall be considered dead; but when the bowler is about to deliver the ball, if the striker at his wicket shall go outside the popping-crease before such actual delivery, the said bowler may put him out, unless (with reference to the 22nd law), his bat in hand, or some part of his person, be within the said crease.

31. If the striker be hurt, he may retire from his wicket and return to it any time during that innings.

32. If the striker be out, some other person may stand out for him, but not go in.

33. No substitute in the field shall be allowed to bowl, keep wicket, stand at the point, cover the point, or stop behind in any case.

34 If any fieldsman stop the ball with his bat, the ball shall be considered dead, and the opposite party shall add five runs to their score; if any be run, they shall have five in all.

35. The ball having been hit, the striker may guard his wicket with his bat, or with any part of his body, except his hands, that the twenty-fourth law may not be disobeyed.

36. The wicket keeper shall not take the ball for the purpose of stumping, until it have passed the wicket; he shall not move till the ball be out of the bowler's hand; he shall not by any noise incommode the striker; and if any part of his person be over or before the wicket, although the ball hit it, the striker shall not be out.

37. The umpires are sole judges of fair and unfair play, and all disputes shall be determined by them, each at his own wicket; but in case of a catch, which the umpire at the wicket bowled from cannot see sufficiently to decide upon, he may apply to the other umpire, whose opinion shall be conclusive.

38. The umpires in all matches shall pitch fair wickets, and the parties shall toss up for the choice of innings.

39. They shall allow two minutes for each striker to come in, and ten minutes between each innings. When the umpires shall call 'Play,' the parties refusing to play shall lose the match.

40. They are not to order a striker out, unless appealed to by the adversaries.

41. But if one of the bowler's feet be not on the ground behind the bowling-crease, and within the return crease, when he shall deliver the ball, the umpire at his wicket, unasked, must call 'No Ball.'

42. If either of the strikers run a short run, the umpire must call 'One Short.'

43. No umpire shall be allowed to bet.

44. No umpire is to be changed during a match, unless with the consent of both parties, except in case of a violation of the 43rd law; then either party may dismiss the transgressor.

45. After the delivery of four balls, the umpire must call 'Over,' but not until the ball shall be finally settled

in the wicket-keeper's or bowler's hands, the ball shall then be considered dead; nevertheless, if an idea be entertained that either of the strikers is out, a question may be put previously to, but not after the delivery of the next ball

46. The umpire must take especial care to call 'No Ball' instant upon delivery, 'Wide Ball' as soon as ever it shall pass the striker.

47. The players who go in second shall follow their innings, if they shall have obtained one hundred runs less than their antagonists.

48. When one of the strikers have been put out, the use of the bat shall not be allowed to any person, until the next striker shall come in.

LAWS FOR SINGLE WICKET.

1. When there shall be less than five players of a side, bounds shall be placed twenty-two yards, each in a line from the off and leg stump.

2. The ball must be hit before the bounds, to entitle the striker to a run; which run cannot be obtained unless he touch the bowling-stump or crease, in a line with his bat, or some part of his person, or go beyond them; returning to the popping crease as at a double wicket, according to the 22nd law.

3. When the striker shall hit the ball, one of his feet must be on the ground, and behind the popping-crease; otherwise the umpire shall call 'No hit.'

4. When there shall be less than five players on a side, neither byes nor overthrows shall be allowed, nor shall the striker be caught out behind wicket, nor stumped out.

5. The fieldsman must return the ball so that it shall cross the play between the wicket and the bowling-stump, or between the bowling-stump and the bounds; the striker may run till the ball be so returned.

6. After the striker shall have one run, if he start again he must touch the bowling-stump and turn before the ball shall cross the play, to entitle him to another.

7. The striker shall be entitled to three runs for a lost ball, and the same number for a ball stopped with bat; with reference to the 29th and 34th law of double wicket,

8. When there shall be more than four players on a

..ere shall be no bounds. All hits, byes, and overthrows shall then be allowed.

9. The bowler is subject to the same laws as at double wicket.

10. Not more than one minute shall be allowed between each ball.

BETS.

1. No bet upon any match is payable unless it be played out or given up.

2. If the runs of one player be betted against those of another, the bet depends on the first innings, unless otherwise specified.

3. If the bet be made upon both innings, and one party beat the other in one innings, the runs of the first innings shall determine it.

4. If the other party go in a second time, the bet must be determined by the number on the score.

[We have appended the laws by which betting is regulated at Lord's celebrated Cricket-ground, because they form a portion of the Rules of Cricket, as laid down by that renowned club; but, however much betting may be tolerated among adults, no one would countenance it in the juvenile; and we trust, therefore, that our young friends need no admonition on our part to avoid a practice that has nothing to recommend it at any time, but, if contracted in youth, may become a rooted vice in maturity.]

BOYS' GAMES.

SKAITING.

SKAITING is so decidedly one of the ancient British pastimes, that even Strutt admits his inability to assign a date to its introduction into this country. It is believed that the present form of the skait was copied from the Low Countries; but it is on record that, long before that instrument was in use in Great Britain, it was the practice of the young citizens of London to fasten the leg-bones of animals under their shoes, and, with the assistance of a pole, thus to propel themselves on the ice. Our northern countrymen, probably from the greater prevalence of frosty weather among them, have been long renowned for their superiority in skaiting; and on the Scottish lakes both ladies and gentlemen assemble in large parties, to perform quadrilles and other dances on the ice. In this country the art has attained great perfection, and the performances of many, particularly among the Skaiting Club, must be seen to appreciate the combined grace and agility displayed. One of the last novelties in this age of scientific progression, is the discovery of a substitute for ice, with which any extent of surface may be covered, so as to enable the skaiter to practise his pastime at all seasons. Whether this will extend the cultivation of the art, or by divesting it of its dangers, deprive it of its fascinations, remains to be seen; but that it gives to those desirous of becoming skaiters facilities not enjoyed by their ancestors, there can be no doubt, and we hope a recreation so truly athletic and graceful will be cultivated in a proportionably increased ratio. The art must be acquired altogether by practice. There are no rules that we can prescribe, and no instructions beyond a recommendation to begin with the confidence that is essential to success.

SLIDING.

A piece of ice, smooth in surface, should be selected, to which a run of some distance may be taken. The slider

has only to take to the slide after his run, with his feet nearly together, and he will soon acquire the knack of propelling himself to its end. The slider generally proceeds in a sidelong attitude, with one foot a little in advance of the other, but some can slide front forward, and with the feet parallel to each other.

LEAPFROG.

Leaping is a capital athletic out-door sport, and may be joined in by any number, provided there be plenty of space. Supposing a dozen engaged in the game, eleven of them must take their positions in a row, each about six yards from the one nearest to him. They should stand with their faces all in one direction, the arms folded or resting on the thighs or knees, the head turned down, so that the chin may touch the breast, the back bent, the shoulders rounded in, and the legs so posited as to keep the body firm. The one not so placed then begins by taking a short run towards the nearest of the eleven, over whom he leaps by placing his hands on his shoulders, and springing from the ground at the same instant. It is the vaulter's province to go clearly over his playmate, with one leg on each side of him, without knocking him down or disturbing his position. In the same way he is to spring over each of his other companions, till he has passed the last of them. He then takes his position at the end of the line, for the others to jump over him in like manner. The first over whom he has leaped follows, vaulting over each of the others as he has done; and thus the game may be continued as far as the space will admit of, or till the parties are tired. Sometimes, in playing at leaping, the person jumped over is placed sideways, so that the jumper has to stretch his legs apart to the utmost, in order to clear him. If the leaper knock down the boy to be leaped over, or do not clear him with the agreed exactness, he is debarred from further leaping, and must take his place at the end or the line, till his next turn arrives.

PRISONER'S BOUNDS, OR BARS.

This is fine open-air exercise for cold weather. Any number may play at it.—A dozen on each side will make good sport; and the players should be divided as fairly as can be. The ground on which the game is to be played must be divided equally between the two parties, and a

line drawn across it constitutes the bounds. A prison is to be marked opposite each other, at the further angle of each division. The sport then commences by one of the players running into the adversaries' quarters, and endeavouring to touch one of them. The party thus chased of course runs to avoid being touched, and one of his party may follow the one in chase of him, and so on, each side being at liberty to send out as many as they think proper. The business of each player is to come up with and touch the adversary who has preceded him before he can reach his bounds. If he succeeds, he has made him prisoner, and he must remain within the prison-bars till one of his party can succeed in rescuing him, by running to him and touching him without being himself touched in the attempt. After he has so touched him, he is entitled to take him back to his own quarters unmolested, and no player is allowed to touch any other than the one after whom he first started. When one side has captured all the players on the other, the game is won.

PUSS IN THE CORNER.

This game may be played either in a room or out of doors. The party must consist of five. Four of them take their places, one in each corner of the room, or if out of doors, at any turn or mark agreed on as a corner, and the fifth has to stand in the centre, till he can get possession of one of the corners, which he can only do when he finds it unoccupied. The fun of the game consists in the players crossing about and exchanging corners, and the endeavour of *puss* to get into one of the vacated positions while thus for the time abandoned. If he succeeds, the party who was running for it, and failed in reaching it before him, becomes Puss, and must so continue till by his activity he can in his turn get possession of an open corner.

BLIND-MAN'S BUFF.

This laughter-provoking game is so universally practised, especially at Christmas, that to describe it is almost superogatory. Any number may play at it. One is made the blind man by having his eyes bandaged with a handkerchief, and it is his province to catch one of his playmates and proclaim his or her name without removing the bandage from his eyes. The party so caught then be-

comes blind-man; and thus the game may be prosecuted for any length of time.

FOLLOW MY LEADER.

The sport of this game depends not only on the agility and daring of the leader, but on his companions being so nearly his match as to justify a reasonable expectation that what he may perform they will be generally able to repeat. Any number may play. The party ranges itself in a line; and the leader commences with some gymnastic effort that his playfollowers are to repeat successively. If either fails in doing so, he is to take his place at the end of the rank; and the parties thus return in the order of their relative achievements.

TOUCH

Is a sport of speed. It is not limited, but about six is a good number to play. One is made Touch, and he is at liberty to chase the whole party, or any one from it that he may select. As soon as he can run one down, so as to touch him, that one becomes Touch till he can transfer the post in like manner. Sometimes touching *iron* or *wood* is held to exempt the player from being made Touch, in which case, Touch can only chase him while he is running from one piece of iron or wood to another.

HUNT THE SLIPPER.

This is generally an in-door game; but there is no objection to playing it in fine dry weather on a grass plat. The players may be young persons of either or both sexes, and the more the merrier. All but one are to sit down in a circle, and a slipper is then given to them. The hunter of the slipper is placed on the outside of the circle, and it is his or her business to get possession of the slipper by feeling for it under and about the legs of the person supposed to have it. Meanwhile the slipper is passed about from one to the other around the ring, any one more venturesome than the others occasionally rapping with it on the floor, to indicate to the hunter where for the instant it is to be found, prior to passing it further along the circle. When the hunter succeeds in finding it, the party from whom he takes it becomes the hunter, in his place.

SADDLE MY NAG.

Six or eight boys, divided into sides, may play at this

game. After settling who is to have the first innings, the losers range themselves in the following order:—One places himself, with his hands resting against a wall or tree, in a bent posture, so as to make a back that the other party can jump upon. Each of his companions then ranges himself in the like way behind him, holding on by the clothes of the one before. The leader of the other party now takes a run, and springs as far up the line of backs as he can, in order to make room for his companions to follow him, which they do in succession, till all are seated on the backs of the other party, or have made the attempt to get on. If they can keep their positions, without touching the ground with hand or foot, while their leader can count twenty, or the nags give way under the burthen, or touch the ground with their hands or knees, they keep their innings, and repeat the mounting of their nags. If otherwise, they become the nags, and the other party the riders. This is not a game we recommend. There is the danger of straining one another's backs, and a probability of tearing the clothes, a thing that good boys take care to avoid in their play.

HOP, STEP, AND JUMP.

This is a game of emulation, the object being to ascertain which of the players can get over the greatest length of ground in a hop, a step, and a jump. The leader begins the game either with or without a preliminary run, as may be agreed on, and the others follow, each endeavouring, of course, to exceed the distance the preceding ones have achieved.

HIDE AND SEEK.

This is an indoor game, and amusing enough to children in bad weather The hider takes a handkerchief or any other small article, and while the other players are not to watch him, conceals it in some part of the room to which the game is confined. The others then attempt to find it and the one that succeeds becomes the next hider. It is customary for the hider to give some intimation of the whereabouts of the hidden prize by calling *hot* when the seekers are near to it, and *cold* as they retrograde from it.

WHOOP.

This game is very like Hide and Seek. All the players

but one are to stop at a place agreed on as home.' The one is then to be allowed to go unwatched to any place within the limits of the playground, and hide himself. When he has done so, he calls 'Whoop!' and all the other players start in search of him. He who discovers him halloos 'Whoop;' the hider then rushes from his hiding-place, and if he can catch one of his playmates, rides 'home' on his back. It now becomes the turn of the boy who made the discovery to hide himself; and thus the game is continued as long as agreeable.

KING OF THE CASTLE.

This must be played where there is a mound or hillock. One player places himself on the summit, and proclaims himself king of the castle. The others singly attempt to displace him by running and butting against him; and the player that is successful is in his turn king of the castle till in the like manner displaced.

BUCK.

This game is very like 'Saddle my Nag' (see above), except that it is played by two boys only. One makes a back, as in Saddle my Nag, and the other, springing on to it, holds up any number he pleases of his fingers, and demands, 'Buck, buck, how many horns do I hold up!' The buck, or horse, is to guess at the number, without endeavouring to look at the player's hand. If he guess rightly, they are to change places; if otherwise, the boy who has held up his hand dismounts, again springs upon his playmate's back, and in the same words again demands the number of fingers held up; and so the game is continued till the number is correctly guessed. In some cases, the boy making the back is blindfolded, and in others an umpire is appointed to take care that he does not look round at his playmate's fingers, instead of guessing; but we would never, by precautions of this kind, presuppose deceit in the playground as well as the school, we would not only inculcate ingenuousness and honour in all transactions, but would always uphold the pupil's self-esteem by giving him credit for every virtue he ought to exhibit, till something occurs to require a less confiding course of conduct. Where, however, an umpire is chosen, instead of being an idle spectator of the game, he might be made the one to take the place of the rider. when guessed

out, and the horse might take his, which would bring the three into play by turns.

HOPSCOTCH.

This game, which in some parts of the country is called Pottle, must be played on a pavement, a floor, or a smooth gravel path. A frame must be drawn with chalk, about ten feet long by four in width. This frame is to be subdivided as follows:—the first section to be formed by drawing a line straight across it, about two feet from the end chalk. The next section is to be four feet from the line last drawn, to be marked out by a line straight across like the other, and to be then subdivided into four by drawing a line across the centre, from each of the upper to the lower corners. The remaining four feet are to be divided equally into two parts, by drawing another straight line through the centre, and the beds, or hops, are then to be numbered as they are formed. The figure thus prepared, one of the players is to take a penny, a button, a shell, or any article agreed on, and standing at a mark drawn some five or six feet from the frame, is to pitch the article into the No. 1 division, or bed. He is then to hop into the same division, or step into it, as may be agreed, and striking the coin, or whatever it may be, with his toe, contrive to julk or scuffle it into No. 2 bed. He is next to strike it with his toe so as to drive it clear out of the hopping-frame, in the direction of the line he entered at. He is then to quit the bed by hopping from No. 2 to No. 1, and then out without touching either of the chalk lines. Returning to the boundary-line, he is to pitch the coin into No. 3 bed, to hop through No. 1 and No. 2, into No. 3, to julk or scuffle the article into No. 4, and thence, at one touch, to cast it again clear out of the bed, towards the starting-line; and then hop out of the bed through 3, 2, and 1, entering each in his way, without touching either of the chalk lines, allowing his second foot to go to the ground, or touching the ground or any thing else with either of his hands. This is to be repeated with each of the other divisions up to No. 7; and then backwards through 6, 5, 4, 3, 2, 1. This done, he is to cast the coin from the line into No. 1, to julk it into No. 2, 3, 4, 5, 6, 7, in succession, and thence down the centre of the hopping-frame towards the starting-line, bringing himself also

home by hopping through each division, in succession. If he can go through this long performance correctly, he has won the game in the first innings: if he fails, the opposite party comes in, and commences the game for his side. If he should break down, the party first in, or his companion, takes up the game at the point to which he had carried it; and so it is pursued until one side has accomplished the feat. The rules of the game require that the hopper should never touch a chalk line, and that he make but one hop in passing from one division to another; but he may touch the coin, &c. as often as he thinks fit, in moving it from one bed to another, provided it never rests on the chalk line.

BASTE THE BEAR.

One boy is chosen for bear, and takes his place on some slight elevation, fit for the purpose. One end of a rope about three yards long is placed in his hand, and a boy chosen as the bear's keeper takes the other end. The other boys are then to attack the bear with twisted handkerchiefs, and the master is to endeavour to touch some one of them. When he succeeds in doing so, without letting go the rope, or pulling the bear from his place, the boy so touched becomes the bear. The bear has the privilege of choosing his own keeper, and the first keeper, if not again chosen, has to become one of the touchers. A boy's having been once bear, or oftener, is no exemption if fairly touched again.

DUCKS AND DRAKES.

This is a feat of skill, and consists in throwing (or shying, as boys call it), pieces of flint, stone, or slate, along the surface of a pond, with such a degree of skill, that, on striking the water, the article will rebound once, twice, or oftener. The first rebound is called a duck, the second a drake; and he who can make the most of them is of course looked upon as the most skilful player. As the loss of the article thrown on the water is the certain consequence of playing this game, spendthrifts who sacrifice their possessions to the enjoyments of the hour, have long been defined as 'making ducks and drakes' of their money.

SWINGING.

This is an exhilarating exercise, especially where the

party swings himself, as from experience we know to be not only practicable, but easy of acquirement. The best swings consist of a plain rope hung by iron rings from a roof or branch of a tree, to within two feet of the ground, with a piece of plank for a seat, grooved at each end for the reception of the rope. Boys generally swing one another, and a long rope is sometimes attached, near the seat of the swing, to facilitate their doing it; but if, on seating yourself in the swing, and setting it in action by the movement of the legs and feet, you throw yourself somewhat backward while the swing is descending one way, and reverse the balance of your weight while descending from the opposite end, you will find the swing not only to maintain its power, but a little practice will enable you, thus unassisted, to swing yourself with great speed, and to the entire stretch of the swing.

WARNING.

Any number may play this game. One is placed within a boundary, and all the others are ranged opposite to him. The one is to endeavour to touch some of the party, but before he leaves his bounds for the purpose, he is to give notice in these words:—'Warning once, warning twice, warning three times over; a bushel of wheat, a bushel of rye,—when the cock crows, out jump I!—Cock-a-doodle doo! Warning!' He then begins his chase, and touches the first he can overtake, who must return with him to his bounds. These two now join hands, and first crying 'Warning!' rush out together, each endeavouring to touch one of their playmates; who must also return to the bounds, and at the next sally join hands with them; and so the game is continued, till every player is touched and taken. As soon, however, as the touchers comprise more than three, the one that began the game is at liberty to join the out-players. It is also lawful to touch while the besieging line is unbroken; and the out-players are at liberty to attack it for that purpose. Directly a player is touched, the line is to separate, and if the out-players can catch any of those belonging it, those caught are compelled to carry their captors to the bounds on their backs.

FRENCH AND ENGLISH.

Six or more boys on each side can play this game. A

boundary-line is drawn, and each party takes one end of a rope, the object being to pull the others across the line, and make them prisoners. The game is won when the players on one side have thus pulled over all their adversaries

THE KITE.

Kites are sold at all toy-shops, and that will generally be the easiest mode of obtaining them; but as some may wish to have them of larger dimensions than those usually prepared for sale, or may have the laudable desire to exercise their ingenuity in constructing one for their own use, we give the following instructions for the making of a kite:—Procure a straight lath or piece of light wood for the stick or upright, and a thin hoop or pliant piece of wood or cane, of proportionate dimensions, for the circular top. Notch the ends and the centre of the bow, thus forming a groove for a string, and then tie them into a semicircle, passing the string once round the upright stick, so as to secure it from running. Next fix a string from the end of the binder on either side to within an inch of the bottom of the upright, making a notch on each side to prevent it from slipping. The skeleton being thus completed, cover the whole with paper of a close hard texture, but light in weight, the outer edges being turned over the external spring and bow, and fastened down with gum or paste. A loop to fasten the string to must now be formed by gimbleting two holes in the upright, one about a fifth of its length from the top, the other at a rather less distance from the bottom, through which a string is to be run, and then knotted. The bow may be decorated with a bunch of paper cuttings. The tail should be about five times the length of the kite, and at intervals of every three or four inches must have bobs of writing-paper, about three inches long, and three or four times doubled, to give them weight and consistence. It will take some practice, and sometimes a good deal of running, to get a kite well up, but it is a very gratifying plaything. The great Franklin did not disdain the use of them, and drew many important deductions from their action in the air. He was in the habit of letting one up previous to bathing, and then allowing himself to be drawn along the water by the force of the air on the kite. He was, however, a first-rate swimmer; and it is only to such that we recommend

the experiment, in case of accident from breaking or letting go the string.

HOOPS.

We need not describe the hoop, and the art of trundling it must be acquired by practice. In some places, pieces of tin are tacked on the inside of the hoop, for the purpose of making a jingling noise; but wooden hoops are now almost thrown out of use by the neat and accurately formed iron ones to be procured at most of the toy-shops. Sometimes boys run races with hoops, the one winning who either keeps his hoop up the longest, or first reaches prescribed home without letting it down. At other times boys contend with hoops, by counting one for every time either can knock down a playfellow's hoop with his own.

BATTLEDORE AND SHUTTLECOCK.

Battledores are either plain thin bats of wood, or are smartly made with a head covered on each side with parchments about an inch apart, so as to yield a drum-like sound when struck. The shuttlecock is a small stock, about an inch in length, set with feathers. If two play, they stand at convenient distances, striking the shuttlecock to and fro between them, the one that misses the fewest times in striking it being the best player. A single player will find battledore and shuttlecock an amusiug exercise.

THE PEA-SHOOTER

is an instrument of tin, from which a pea may be propelled a considerable distance by the mere force of the breath. From this comparatively foolish toy has emanated a game called

BLOWING WITH THE DART.

which has its uses in practising the eye in aiming at an object. A small target is placed against a wall, and in lieu of peas the players are supplied with small darts, with pins in one end to stick into the target, and a circle of feathers, or some expanding object, at the other, to insure the entire filling of the tube by the base of the dart. The one who can oftenest strike the bull's eye by propelling his dart with the breath becomes the winner of the game

THE POPGUN

is made of a piece of straight elder-wood, from which the

pitch has been extracted, or it may be purchased at the toy-shops. It has a stick or rammer, nearly as long as the gun. A piece of wetted paper or tow is put tightly into one end, and then driven gently to near the other end of the gun by the rammer or stick. A second pellet, like the first, is now placed within the other end, and if the rammer is then smartly driven through the gun, the consequent compression of the air will propel the first pellet to a considerable distance, and with a loud pop or report. The other pellet must then be made to supply the place of the first, a fresh one must be introduced at the near end of the tube, with which the other will be ejected, and thus the pastime may be continued.

THE RIFLE POPGUN

is a considerable improvement on the preceding. It consists of a tube about two feet long, fixed to a stock, by looking along which tolerable aim may be taken at a target. Each player should have pellets of different colours, so as to be able without difficulty to identify them; and the pellets should be made of soft wax, or some adhesive matter, so that those that strike the target may stick to it.

THE SUCKER

is a circular piece of stout leather, with a piece of string passed through the centre, and secured on the under side by a knot. If this leather be well soaked in water, and then closely pressed on any object of moderate weight—such, for instance, as a brick, it will adhere so closely to it as to enable the player to lift and carry the article about.

THE SLING

was an ancient instrument of warfare, and most of our young readers have read, we presume, in Scripture and elsewhere, of the skill with which the instrument was used in early ages. In the playground a plain strap, from three to four feet long, is sufficient for practice. One end must either be fastened to the wrist, or held securely in the hand. The other must be held lightly. In the loop thus formed in the centre of the strap, place the missile, and after whirling it round and round till you consider you have given it sufficient power to reach the object aimed at, let go the end of the strap you have been instructed to hold the lightest, and the missile will take its departure with great force and velocity.

GAMES WITH MARBLES.

Ring-Taw is generally played as follows;—A circle is formed, within which each party places one or more marbles, as may be agreed on. A shooting-line, called the offing, is drawn at an agreed distance, and from this line each player shoots his taw, as the marble thus used is designated, up to the ring. If he strikes one of the marbles out of the ring, he is entitled to take it up and to shoot again, so that a clever player, having won the chance of beginning the game, may clear the ring before his companions get an innings. The offing is only used for the first shooting, the rules requiring the player to shoot from the point at which his taw rests. If the player miss striking a marble, he is out; if, besides missing it, his taw remains within the ring, he is not only out, but he must restore to the ring any marbles he may previously have won. If, however, a player strikes the taw of another, the owner of the taw is out; and if the said owner of the stricken taw has previously won any marbles from the ring, he must yield them to the playmate who has so struck him.

Increase-Taw is so designated on account of the tendency of the rules to increase the number of marbles within the circle; and it is in this peculiarity that consists its main difference to *Ring-Taw*. If a player shoot his taw within the ring before any marble has been struck out of it, he puts another shot in, and shoots again from the offing; if a taw, while in the ring, is struck by another, unless that of a partner, the owner of the one so struck must leave his taw or another marble in the ring, and if he has previously won any marbles in the game, he must hand them over to the party that strikes him. If he has not won any thing, he is *killed*, or out of the game. If, after a shot has been struck from the ring, a player's taw gets within it, the owner must put into the ring any shots he may have obtained in the game, and one additional, and then shoot from the offing: if he then fail in striking any thing from the ring, he is said to 'get fat,' and is considered killed, or out of the game; but when the marbles in the ring are reduced to one, the taw may remain in without bringing the player within this forfeiture.

GAMES WITH TOPS.

Peg-Tops with heavy bodies and short pegs spin much more steadily, or *sleep* as the boys call it, than those of less bulk, and on larger pegs. From this hint our young friends will know how to select the top most appropriate to the pastime they are about to practise. Some merely spin a top to see how long it will stand on the ground, or how often they can take it up in a wooden spoon; but parties of boys often play a game in this way:—A circle about three feet in diameter is drawn on the ground, and, after deciding who is to begin, one of the players spins his top into it. Another immediately casts his top at it in a spinning state, endeavouring to split the top of the first player with the peg of his own. In like manner, all the players follow, each being at liberty to strike any one of the tops while in the circle, and should he succeed in splitting it, being entitled to keep the peg as a trophy; and many pegs do some of the most adroit at this game boast. Directly, however, a top gets beyond the ring, in a spinning state, the owner takes it up, and with all speed returns to the game. If, however, a top drops within the circle, or rolls out of it after it is spent, or if the owner sets it spinning beyond the circle, or after being thrown it fail to spin, in either of these cases it is called 'a dead top,' and is placed in the centre of the ring for the others to peg at. If knocked out without being split, the owner takes it up and resumes the game. In winding, the cord should be carried round the greater part of the peg as well as the groved part of the top. Peg-tops, however, are toys with which mischief may be done; and we therefore much more commend

Whip-Top, which is a capital exercise, and free from objection of any kind. The top must be procured from a shop, where also whips of eelskin are sold. An expert player may, however, keep up a top with a strap and other substances of a more lasting quality than eelskin. A little practice will teach him how to put the top in action with the hands which is then to be continued by the whip. One can play at whip-top; where more than one have the use only of one top, the innings of each lasts as long as he can keep the top up. Where each player has a top, races may be

made up by trying which can quickest whip his top fr n one specified bound to another; or 'encounters' may be played by one trying to knock down the top of the other by whipping his top against it.

The *Humming-Top* is a pretty toy for young people, particularly for little ladies. When neatly made, and especially if formed of ivory or coquilla, it will spin for a considerable length of time, and emit a loud humming. The string has merely to be wound round the stick prepared for its reception; one end of it is then taken in one hand, and the handle in the other; and if the string is drawn off with tolerable speed and adroitness, the spinning of the top is insured.

GAMES WITH BALLS.

Fives, or *Tennis*.—This is an ancient game; and a tennis-court was a common adjunct to the mansions of our ancestors. It is played with small hard white balls, and a bat formed of a straight stick, about 30 inches long, with a circle of wire-work at the end, wherewith to strike the ball. The play-place must have at one end of it a tall wide wall, and a considerable area of good level ground in front. Bounds are to be marked by drawing lines horizontally along the wall, about three feet from the ground, across the ground about six feet in front of the wall, and again at a greater distance, as may suit the capacity of the playground or the inclination of the players. The bounds will be completed by drawing a line at each end of these, on the ground, to the wall, and thus forming a square. The game may be played either singly or with partners. Having tossed up for innings, the winner begins by letting the ball to the ground with such an impetus that it will rebound to a suitable height, and then with his bat driving it to the wall, above the chalk line, and so that it shall rebound over the first line to within the bounds. As it rises, the other player then strikes it in like manner against the wall, and so the game continues till one of them misses, or strikes the ball beyond the bounds, or fails to strike it before it has rebounded more than once. The game is fifteen, towards which the in-party counts one for every good ball made, and the out-party for

every one missed, the party in losing the innings also so soon as a ball is missed. After the ball is started on each occasion of going in, it is not necessary that it should drop beyond the first line, that line being placed merely to make the first that throws the ball do it fairly for the strikers.

TRAP, BAT, AND BALL.

Next to Cricket, no game offers more amusement, both for sport and exercise, than Trap, Bat, and Ball; and its popularity is so universal, that we need not minutely describe the tools. The game may be played by two, or by parties divided equally on each side, in proportion to their assumed skill at the game. A number being agreed on as the game, in which case each side will go in till the number is made, the innings are tossed for, and the first of the party to go in places the ball in the spoon of the trap, strikes the trigger gently with the bat so as to make the ball jump into the air, and then with the bat either drives it as far as he can, or demonstrates his skill by propelling it to the spot at which there is the least likelihood of his being catched out. The out-players endeavour to catch it; but should they not do so, either before it falls or before it has rebounded more than once, the one by whom it has been stopped bowls or throws it at the trap. Should he strike the trap, the player is out: as he is also should the ball be caught, or fall within the bound which many players at this game draw in front of the trap, and at the sides of the playground; but if otherwise, the player scores one towards the game. The boundary-line is sometimes made also a running-crease, and any runs the player can perfect between that line and the trap before the return of the ball, are counted towards the game; but should the ball reach the trap before him, although it may not strike it, he will lose his innings.

NINE HOLES.

Near a wall or fence there must be as many holes dug as there are players. They must be large enough and clear enough to admit of the ball being readily bowled into them. One of these holes must be assigned to each of the players. About five yards in front of the holes a line is to be drawn, at which one of the players places himself, and endeavours to bowl the ball into one of the

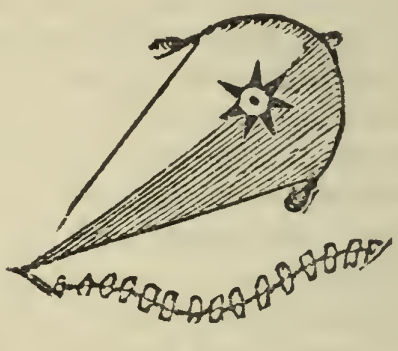
holes. The player to whom the hole belongs immediately picks up the ball, and throwing it at the other players, who all run off as quickly as they can, endeavours to strike one of them. Should he miss, he loses a point, is designated a fifer, and has to take his turn at throwing at the holes; should he, however, succeed in striking another, the party so struck takes up the ball and casts it at another, either taking a point or becoming a fifer, as he may succeed or fail, and in the latter case having to throw at the holes. Thus the game is continued till all but one is out. If the thrower misses a second time, he becomes a tenner; if a third time, a fifteener; and for each lache he loses a point. By the same rule, the bowler is a fifer for one miss, a tenner for a second, and a fifteener for a third, and loses a point for each miss. If he bowls into his own hole, it is equally a miss, and the one most likely to provoke laughter. When the game is thus far over, the first of the losers takes the ball in his left hand, places himself with his face towards the wall or fence, and casts the ball over his right shoulder, to as great a distance as he can. From this spot, or from one parallel to it, but immediately behind the back of the one who has cast the ball, the winner has the privilege of three throws at the back of each of the losers. We have seen some avail themselves of this privilege to strike their playmates with all their strength; but we hope our young readers will always bear in mind that mercy should attend on victory, and never allow cruelty to interrupt the good will that should be nurtured by their pastimes.

CATCH-BALL

Is somewhat similar to Nine-Holes, with this difference, however, that in lieu of using holes, the players stand in a circle, and the holder of the ball casts it into the air, calling on one of his companions by name to catch it. If the one so called on catches it before it has rebounded from the earth, he throws it up, and in like manner calls on some other playfellow to catch it. Thus the game is continued till some one fails to catch the ball, in which case he is to throw it after one of his playmates, trying to strike him; if he again fail, he loses a point, and then throws the ball up, calling on some one by name, as before, to catch it. When the game has been pursued till the winner is ascertained, it is played off exactly like Nineholes.

FOOT-BALL.

For this game a large light ball is required, such as those sold at the toy-shops, made of India-rubber, with a netting around it, or a bladder inflated and strengthened with a casing of leather. The players, the more the better, are to be equally divided; and two lines, from fifty to a hundred yards apart, are to be drawn across the play-place. In the middle of the space thus marked out, the ball is placed. Each party advances from the goals formed by the lines, and the sport consists in endeavouring to kick the ball into the quarters of the opponent. It is a game at which much injury may be done to the shins and legs, and we therefore do not recommend it.



ARITHMETICAL PASTIMES.

TO TELL BY A WATCH DIAL THE HOUR WHEN A PERSON INTENDS TO RISE.

THE person is told to set the hand of his watch at any hour he pleases, which hour he tells you, and you add in your mind 12 to it. You then desire him to count privately the number of that addition on the dial, commencing at the next hour to that at which he intends to rise, and including the hour at which he has placed the hand, which will give the answer. For example

A. intends to rise at 6 (this he conceals to himself); he places the hand at 8, which he tells B who, in his own mind, adds 12 to 8, which make 20. B. then tells A. to count 20 on the dial, beginning at the next hour to that at which he proposes to rise, which will be 7; and counting backwards, reckoning each hour as 1, and including in his addition the number of the hour the hand is placed at, the addition will end at 6, which is the hour proposed: thus,

The hour the hand is placed at is.....	8
The next hour to that which A. intends to rise at is 7, which counts for.....	1
Count back the hours from 6, and reckon them at 1 each, there will be 11 hours, viz. 4, 3, 2, 1, 12, 11, 10, 9, 8, 7, 6.....	11
Making.....	20

A PERSON HAVING AN EVEN NUMBER OF SHILLINGS IN ONE HAND, AND AN ODD NUMBER IN THE OTHER, TO TELL IN WHICH HAND THE ODD OR EVEN NUMBER IS.

You desire the person to multiply the number in his right hand by an odd figure, and the number in his left by an even one, and to tell you if the products, added together,

be odd or even. If even, the even number is in the right hand; if odd, the even number is in the left. For instance,

I. Number in the right hand is even.....	18	In the left hand odd..	7
Multiply by.....	3	Multiply by.....	2
Product....	54	Product....	14
Add the Product of the left hand.....	14		
Which produces a total of.....	68		

II. Number in the right hand is odd.....	7	In the left hand even...	18
Multiply by.....	3	Multiply by.....	2
Product....	21	Product....	36
Add the Product of the left hand.....	36		
Which produces a total of.....	57		

TO TELL A PERSON ANY NUMBER HE MAY PRIVATELY FIX ON.

When the person has fixed on a number, bid him double it and add four to that doubling; then multiply the whole by 5; to the product let him add 12, and multiply the amount by 10. From the total of all this, let him deduct 320, and tell you the remainder; from which, if you cut off the two last figures, the number that remains will be what he fixed on. For instance,

Suppose the number chosen is.....	7
Which doubled is.....	14
Add 4 to it, and it will make.....	18
Multiply 18 by 5, which gives	90
To which add 12, making.....	102
Multiply that by 10, making.....	1020
From which deducting 320, the remainder is	700
And by striking off the two ciphers, it becomes the number thought on.....	7

TO FIND THE NUMBER OF CHANGES THAT MAY BE RUNG ON TWELVE BELLS.

Multiply the numbers from 1 to 12 continually into each other, as follow: and the last product will give the number required.

```
          1
          2
        ---
          2
          3
        ---
          6
          4
        ---
         24
          5
       -----
        120
          6
       -----
        720
          7
       -----
      5,040
          8
     -------
     40 320
          9
     -------
    362,880
         10
   ---------
  3,628,800
         11
 -----------
 39,916,800
         12
 -----------
479,001,600
```

TO FIND HOW MANY SQUARE YARDS IT WOULD REQUIRE TO WRITE ALL THE CHANGES OF THE TWENTY-FOUR LETTERS OF THE ALPHABET, WRITTEN SO SMALL, THAT EACH LETTER SHALL NOT OCCUPY MORE THAN THE HUNDREDTH PART OF A SQUARE INCH.

By adopting the plan of the preceding article, the changes of the twenty-four letters will be found to be

62,044,840,173,323,943,936,000.

Now the inches in a square yard being 1296, that number multiplied by 100 gives 129,600, which is the number of letters each square yard will contain; therefore, if we divide the above row of figures (the number of changes) by 129,600, the quotient, which is

478,741,020,720,095,160,

will be the number of yards. But as all the 24 letters are contained in every permutation, it will require a space 24 times as large, viz.

11,849,785,210,282,211,840.

Now, as the surface of the whole globe only contains 617 197,435,008,000 square yards, it would require a surface 18,620 times as large as the earth to contain them.

TO TELL ANY NUMBER A PERSON HAS FIXED ON WITHOUT ASKING HIM ANY QUESTIONS.

You tell the person to choose any number from 1 to 15; he is to add 21 to that number, and triple the amount. Then

1. He is to take the half of that triple, and triple that half.
2. To take the half of the last triple, and triple that half.
3. To take the half of the last triple.
4. To take the half of that half.

Thus, it will be seen there are four cases where the half is to be taken: the three first are denoted by one of the eight following Latin words, each word being composed of three syllables, and those that contain the letter I, refer to those cases where the half cannot be taken without a fraction; therefore, in those cases, the person who makes the deduction is to add 1 to the number divided. The fourth case shows which of the two numbers annexed to every word has been chosen; for, if the fourth half can be taken without adding 1, the number chosen is in the first column; but if not, it is in the second column.

The words.	*The numbers they denote.*	
Mi-se-ris	8	0
Ob-tin-git	1	9
Ni-mi-um	2	19
No ta-ri	3	11
In-fer-nos.	4	12
Or-di-nes	13	5
Ti-mi-di	6	14
Te-ne-ant.	15	7

For example:

Suppose the number chosen is	9
To which is to be added	1
	10
The triple of that number is	30
The half of which is	15
The triple of that half must be . . .	45
And the half of that*	23
The triple of that half	69
The half of that*	35
And the half of that half*	18

While the person is performing the operation, you remark, that at the second and third stages he is obliged to add 1; and, consequently, that the word *ob-tin-git*, in the second and third syllable of which is an *i*, denotes that the number must be either 1 or 9; and, by observing that he cannot take the last half without adding 1, you know that it must be the number in the second column. If he makes no addition at any one of the four stages, the number he chose must be 15, as that is the only number that has not a fraction at either of the divisions.

A PERSON HAVING PUT A RING ON ONE OF HIS FINGERS, TO NAME THE PERSON, THE HAND, THE FINGER, AND THE JOINT, ON WHICH IT IS PLACED.

Let a third person double the number of the order in which he stands who has the ring, and add 5 to that number; then multiply that sum by 5, and to the product add 10. Let him next add 1 to the last number, if the ring be on the right hand, and 2 if on the left, and multiply the whole by 10: to the product of this he must add the num-

* At all these stages 1 must be added, to take the half without a fraction

ber of thefinger (counting the thumb as the first finger), and multiply the whole again by 10. Let him then add the number of the joint, and, lastly, to the whole join 35

He is then to tell you the amount of the whole, from which you are to subtract 3535, and the remainder will consist of four figures: the first of which will express the rank in which the person stands, the second the hand, (number 1 signifying the right, and 2 the left), the third number the finger, and the fourth the joint.—For example:

Suppose the person who stands the third in order has put the ring upon the second joint of the thumb of his left hand; then

The double of the rank of the third person is	6
To which add	5
	11
Multiply the sum by.....	5
	55
To which add.....	10
And the number of the left hand	2
	67
Which being multiplied by	10
	670
To which add the number of the thumb	1
	671
And multiply again by.....	10
	6710
Then add the number of the joint.....	2
And lastly, the number.....	35
	6747
From which deducting	3535
The remainder is	3212

Of which, as we have said, the 3 denotes the third person, the 2 the left hand, the 1 the thumb, and the last 2 the second joint.

TO FIND THE DIFFERENCE BETWEEN TWO NUMBERS, THE GREATEST OF WHICH IS UNKNOWN.

Take as many nines as there are figures in the smallest number, and subtract that sum from the number of nines. Let another person add that difference to the largest number, and taking away the first figure of the amount, add it to the last figure, and that sum will be the difference of the two numbers.

For example, Robert, who is 22, tells George, who is older, that he can discover the difference of their ages; he therefore privately deducts 22 from 99, and the difference, which is 77, he tells George to add to his age, and to take away the first figure from the amount, and add it to the last figure, and that last sum will be the difference of their ages. Thus, the difference between

Robert's age and 99, is.....	77
To which George adding his age.....	35
The sum will be.....	112
	12
	1
Then by taking away the first figure, 1, and adding it to the last figure, 2, the sum is.....	13
Which added to Robert's age.....	22
Gives George's age, which is.....	35

TO MAKE ANY NUMBER DIVISIBLE BY NINE BY ADDING A NUMBER TO IT.

If (for example) the number named be 72,857, you tell the person who names it to place the number 7 between any two figures of that sum, and it will be divisible by 9; for if any number be multiplied by 9, the sum of the figures of the product will be either 9, or a number divisible by 9.

ARITHMETICAL SQUARES.

An arithmetical magical square consists of numbers so disposed in parallel and equal lines, that the sum of each, taken any way of the square, amounts to the same.

A Natural Square.

A G B

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25

E

C H D

A Magical Square.

A B

11	24	7	20	3
4	12	25	8	15
17	5	13	21	9
10	18	1	14	22
23	6	19	2	15

F

C D

Any five of these sums taken in a right line make 65. You will observe that five numbers in the diagonals A to D, and B to C, of the magical square, answer to the ranks E to F, and G to H, in the natural square, and that 13 is the central number of both squares.

To form a magical square, first transpose the two ranks in the natural square to the diagonals of the magical square; then place the number 1 under the central number 13, and the number 2 in the next diagonal downward. The number 8 should be placed in the same diagonal line; but as there is no room in the square, you are to place it in that part it would occupy if another square were placed under this. For the same reason, the number 4, by following the diagonal direction, falling out of the square, it is to be put into the part it would hold in another square, placed by the side of this. You then proceed to numbers 5 and 6, still descending; but as the place 6 should hold is already filled, you then go back to the diagonal, and consequently place the 6 in the second case under the 5, so that there may remain an empty space between the two numbers. The same rule is to be observed whenever you find a space already filled.

You proceed in this manner to fill all the empty cases in the angle where the 15 is placed; and as there is no space for the 16 in the same diagonal, descending, you must place it in the part it would hold in another square, and continue the same plan till all the spaces are filled. This method will serve equally for all sorts of arithmetical progressions composed of odd numbers; even numbers being too complicated to afford any amusement.

TO MAKE BALLOONS.

Aerostation, the term by which the science of Ballooning is designated, is derived from two Greek words, signifying *Air* and *Weight;* and the whole theory of Aerostation consists in this—that any body which is specifically, or bulk for bulk, lighter than the atmospheric air that encompasses the earth, will be buoyed up by it, and ascend to the height at which the surrounding air will be of the same specific gravity with itself. In this situation, it will travel in the direction of the wind or current of air to which it is exposed, till the gradual waste or escape of the lighter atmosphere within it so far increases the gravity of the balloon as to again bring it to the ground. To construct a balloon, therefore, the dimensions of the bag or vessel to contain the light atmosphere must be so proportioned to the whole mass to be raised, that, when inflated, and with all its appendages annexed, it shall be of less specific gravity than the common air.

Heat is well known to rarefy and expand, and consequently to lessen, the specific gravity of the air to which it is applied. One degree of heat expands the air about one four-hundredth part; and 435 degrees of heat just double the bulk of a quantity of air. It was a knowledge of these facts in science that first led Montgolfier, a native of Annonay, in France, to form the opinion that a machine might be made to travel through the air In 1782, at Avignon, he tested his theory, with a fine silk bag, of a parallelopiped form, the air in which he rarefied by burning paper under the mouth of it. In 1783 he made a public exhibition of his invention with entire success; and hence fire or hot-air balloons are to this day called Montgolfiers. The rarefaction of the air is now more nicely produced by the burning of spirits of wine in a sponge; but the principle—that of lightening air by heating it—is the same.

If, however, instead of thus diminishing the weight of

common air, the case be filled with an elastic fluid lighter than the common air, so that the excess of the weight of an equal bulk of the latter, above that of the enclosed elastic fluid, be greater than the weight of the covering and its appendages, the whole mass will ascend in the air, and continue so to rise till it attains a height at which the surrounding atmosphere is of the same specific gravity with itself. Hydrogen gas is a fluid of this description, and so is the ordinary coal gas. Although far from so light as hydrogen, it is now generally used for the inflation of balloons, Mr. Charles Green, the renowned aeronaut, having been the first to demonstrate its efficiency for that purpose. Hydrogen gas, which is seven times lighter than common air, may be generated by the immersion of iron filings in diluted vitriolic acid.

After these remarks, our young aerostat, in making his balloon, will select materials as light as possible, consistent with the required strength. As he is not likely to have the command of silk, the material should be a fine, thin, close-textured tissue-paper. This may be procured of various hues at most stationers, and the elegance of the balloon will thus be increased. Having determined that the balloon shall consist of a specific number of gores, or sections, say 32 or 16, a pattern for cutting them by should be made of paste-board, or some tolerably hard substance. Suppose the entire height of the balloon, without its appendages, is to be three feet, and the number of gores thirty-two, an elegant shape will be got by making the pattern an inch wide at one end, three inches at the other, and eight inches at its broadest part, which should be at one third of its length, if the balloon is intended to have a pear-like figure: its symmetry will depend much on all the gores being cut exactly of a size. The materials in this stage may be varnished with the ordinary burned oil, and hung up singly on lines till perfectly dry. They are next to be put together, which may be done with gum-water, or clean thin paste. Pasting or gumming about half an inch of one of the gores, lay the edge of another about midway across the part pasted, and then double over about a quarter of an inch of it, dabbing it lightly from end to end with a clean cloth, to insure its holding securely. Two of the gores being thus united, do not proceed to put a third one to them, but unite two others

in the like manner, and so on till, if you have had 32 gores in all, you reduce your number to 16. In like manner proceed till you make your number eight, then four, and then two, hanging the sections up at each pasting, so that they may get thoroughly dry as you proceed. The two halves are last of all to be connected in the same way; and this part of the undertaking is then completed. If it is to be a Montgolfier, or fire-balloon, a circle of wire about six inches in diameter should be worked into the bottom of it, to keep the fabric of the balloon at a sufficient distance from the flame of the spirit. Another wire may be fixed across this circle to hold a piece of sponge, which, immersed in spirits of wine and ignited, will in a few minutes put the balloon in ascending condition.

Where it is intended to inflate the balloon with hydrogen or coal gas, the latter apparatus is not needed; but a light car, or any other ornament proportioned to the ascending powers of the balloon, may be appended to it, which will have the effect of maintaining it in its right position, and also of keeping it longer in sight than it would otherwise remain.

ARCHERY.

The length of a bow for an adult gentleman should be from five feet eight inches to six feet; for a lady, from five feet to five feet six inches. The tyro must select his bow and other implements proportioned to his height and strength, bearing the above general rule in mind, and also that the curve, when the bow is fully distended, should form a perfect semi-circle. Arrows for bows of five feet long should be 24 inches in length, and their weight should depend on the distances to be shot; the lighter arrows being used for the longer distances. It is the practice among Toxopholites to weigh arrows against silver coin; and the weight varies from 2*s.* to 1*s.* The pile of the arrow is the point; the nook is the grove at the other end, made for the reception of the string. The diameter of a gentleman's target is four feet; ladies' targets are made considerably smaller. In the centre is a gold eye, surrounded first by a red circle, next by a white one,

then by a black one, and lastly by another white one, each possessing value in proportion to its proximity to the centre. A hit in the eye counts for 9; in the red circle for 3; in the white for 2; in the next 5 hits count as four, and in the last circle as 1. The outer margin of the target is called the petticoat. The usual shooting distance for gentlemen is 100 yards; for ladies one half the distance prescribed for gentlemen, whatever that may be. Each shooter is allowed to use two arrows at each shooting, and is generally supplied with a third, in case of accident to either of them. The winner is the person who makes the greatest number of hits, according to the plan just described, and sometimes the one who shoots nearest the centre; but it is better to combine the two plans, as the centre may be reached by a chance shot from the least skilful.

The attitude of the archer should be such that the side of his body be towards the mark, by which, if the target be due north, he will directly face the east. Taking the arrow by its middle, and turning uppermost the part containing what is called the cock feather, with the right hand he places the string *well home* in the nook, and raising the bow horizontally, with both hands he draws it till the pile projects but about an inch from the aft of the bow, the fore-finger of the left hand being occupied in keeping the arrow in its correct position. With a moment's aim, and no more, the arrow must be launched for its destination. On the judgment in taking aim, of course, mainly depends the success of the Toxopholite. Some are accustomed to look along the arrow at the mark prior to shooting; but the best authorities hold that the right plan is to keep the eye steadily fixed on the guerdon. The drawing hand must be brought a little below the ear in target-shooting; and be more or less depressed for longer distances, in proportion to the curve the arrow has to make.

Having thus concisely given the leading principles and rules of Archery, the tyro will know how to modify them, according to his capabilities; and we take leave of the subject and himself by advising him not to be over ambitious,—but to begin with small tools and small distances, in the assurance that a command over the bow can only be obtained by degrees and by patient practice.

LEGERDEMAIN;

OR

THE ART OF CONJURING.

THE THIMBLE RIG.

Thousands annually fall victims to the men who attend races and fairs for the purpose of profiting by their ingenuity in practising the sleight-of-hand now so well known as the *thimble rig*. The conjuror's trick with the cups and balls exemplifies the whole plan of operations of these tricksters; and if those who look with amazement on the ingenuity of the sleight-of-hand master, while, through the well-recognised greater fleetness of motion compared with vision, he is enabled to delude the spectator as to the position of substances so much beyond the size of those with which the thimble-rig gentry fleece the unsuspecting, would reflect, as they ought to do, on the fact which the honest exemplifier of legerdemain never attempts to conceal, that the eye is deceived—that abstraction, substitution, and transposition of even large substances can be made with an adroitness that the vision cannot keep pace with, we should be spared the many recitals that we have now to listen to, of children, servants, and uneducated people losing all their little savings through the vanity of fancying themselves matches for the keeper of a thimble-table. With these precautionary remarks, we introduce the trick of

THE CUPS AND BALLS.

Provide yourself with a small black or dark-coloured stick, which you may designate your wand of magic; and, in doing the trick, where you have occasion to touch the cups, use this stick as much as possible, in lieu of your fingers, as the less you handle the cups the greater will be the wonderment of the beholders. Place yourself at the farther end of the table, and furnish yourself with three cups made of tin, and four small cork balls to play with; but do not let any more than three be seen upon the table.

Conceal one ball in the right hand, between the middle finger and the ring finger; and be sure you make yourself perfect to hold it there, for by this means all the tricks of the cups are done.

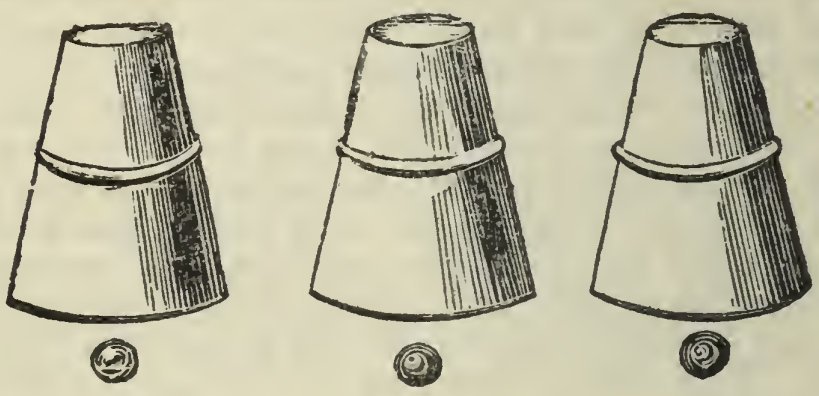
You may then say as follows, for such is the fact, and your avowal of it will not enable the spectator to detect you any the more, if the trick is cleverly done—'If your eyes be not as quick as my hands I shall deceive you all:

'View them within, view them all round about,
Where there's nothing in, there's nothing can come out.'

Then take your balls privately between your fingers, and so fling one of them upon the table, and say thus:

'The first trick that I learned to do,
Was out of one ball to make it into two:
Ah! since it cannot better be,
Out of these two I'll divide them into three,
Which is called the first trick of dexterity.'

So then you have the three balls on the table to play with, and one left between the fingers of your right hand.

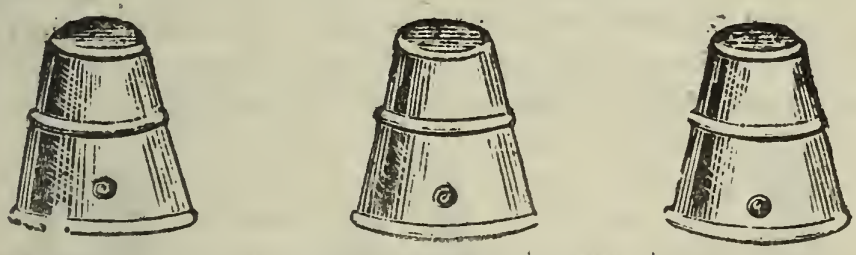


You may then say, 'You see here are three balls, and here are three cups,—that is, a cup for each ball, and a ball for each cup.' Then taking the ball which you have in your right hand (which you are always to keep private), and clapping it under the first cup, take up one of the three balls with your right hand, seeming to put it into your left hand, but retain it still in your right, shutting your left hand in due time, and then say, *Presto, begone.*

Next take the second cup, saying, 'You see there is nothing under my cup;' so clap the ball under that you have in your right hand, and then take the second ball up with your right hand, and seem to put it into your left

hand, but retain it in your right, shutting your hand in due time, as before, saying, *Presto, begone.*

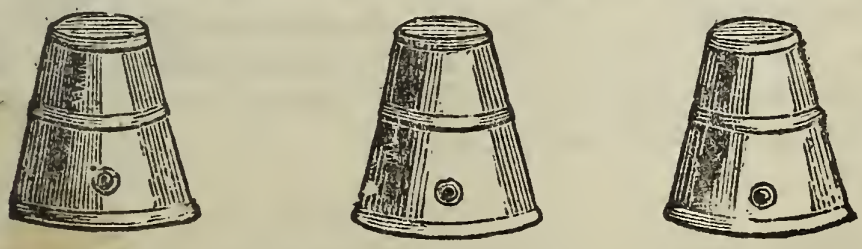
Now take the third cup up, and say, 'You see there is nothing under my last cup;' then, clapping the ball under your right hand, and taking the third ball up with your right hand, seem to put it into your left hand, but retain it in your hand; so shutting your left hand in due time, as before, saying, *Presto, make haste*, you have your three balls under your three cups. You will now raise the cups one by one, and exhibit the three balls to the company.



Then with your right hand take up the first cup, and then clap the ball under that you have in your right hand; then say, 'This being the first ball, I'll put it in my pocket;' but that you must still keep in your right hand to play with.

So take up the second cup with your right hand, and clap that ball under which you have concealed; and then take up the second ball with your right hand and say, 'This likewise I take and put into my pocket.'

Then take up the third cup, and, clapping the cup down again, convey the ball that you have in your right hand under the cup; then take the third ball, and say, This being the last ball, I take this and put it in my pocket likewise.' Then say to the company, 'Now, by a little of my fine powder of experience, I'll command these balls under the cups again.' So raise them all along the table, to the admiration of the beholders.

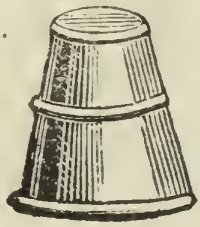
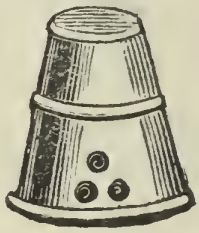
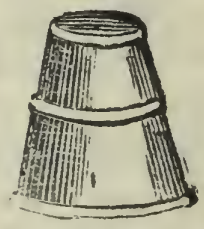


Then take up the first cup, and clapping the ball under it, that you have in your right hand, and then taking the

first ball up with the right hand, seem to put the same into your left hand, but retain it still in your right hand; then say, *Presto, quick, begone when I bid you, and run under the cup.*

Then taking that cup up again, and flinging that ball under that you have in your right hand, you must take up the second ball, and seem to put it into your left hand, but retain it in your right hand, saying, 'See how the ball runs on the table,' seeming to fling it away.

Taking the same cup up again, and clapping the ball under again as before, take the third ball in your right hand, seem to put it under your left, but still retain it in your right; then with your left hand seem to fling it in the cup, and all the three balls will be under one cup.'

If you can perform these actions adroitly with the cups, you may change these balls for apples, pears, plums, or even living birds; but you should be well assured of your neatness of action before you venture on substances that will assuredly betray you if not cleverly handled.

THE CONJUROR'S DESSERT.

Cut some apples that are of a yellowish tint; cut several pieces to look like candle-ends, round at the bottom and flat at the top, making them resemble as nearly as possible candles which have been burned to within an inch or two of the end; then cut some pieces of sweet almonds, about the thickness of the wick of a candle, and having lighted each for a minute to make it black, fix them into the apple candles. When you want to use them, light the wick; and, whilst it is yet alight, put it quickly into your mouth, and, appearing to relish it exceedingly, eat it up; and so on till they are all gone.

THE ROLLING EGG.

Procure a goose's egg, and make a hole in it, sufficiently large to enable you to take out the inside, and having

carefully dried the inner part of the shell, introduce a small live bat; then with a piece of glued paper close the aperture, taking care to make a breathing-hole, which having done lay the egg on a tray, or some place where it is not likely to fall: the movement of the bat will then cause it to roll about in a manner perfectly astonishing to those who are not aware of its contents.

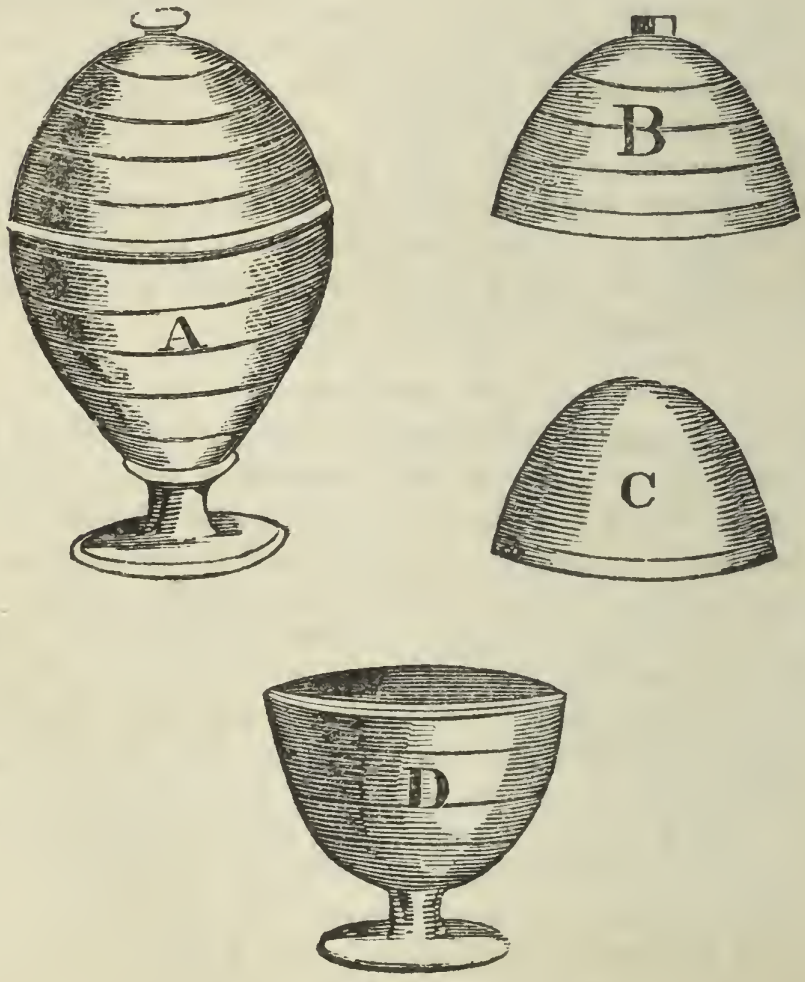
TO MAKE AN EGG STAND ON ONE END ON A TABLE, OR ON A LOOKING-GLASS.

To make an egg stand on end on any polished surface seems very extraordinary, yet it is to be done, even on a looking-glass: for, from the form of an egg, nothing is more liable to roll, and on nothing more so than a looking-glass. To accomplish this attractive trick, let the performer take an egg in his hand, and while he keeps talking, and staring in the face of his audience, give it two or three hearty shakes; this will break the yolk, which will sink to one end, and consequently make it more heavy, by which, when it is settled, you may make it, with a steady hand, stand upon the glass, which would be impossible while it continued in its proper state.

THE EGG-BOX.

The lower part of the egg-box is in the form of an egg-cup; the upper part, or lid, resembles a bee-hive, and when these two are united, they form the figure marked A: the cap C is covered with the half of an eggshell, or some composition which has the same appearance: it is made to fit the cup D, and is a size smaller than the lid B, which allows of its being shut in by it. Place B, which is the lid, upon C, which is the half-egg; then place both these upon D, which is the lower part of the box or egg-cup, and the whole is ready for the use of the performer. Now ask for an egg, and desire those about you to examine it, in order that they may be certain it is a real one. Then remove the upper parts, B and C, with your finger and thumb, keeping your other fingers as much as possible away from the box, and putting the egg in the box, say, 'Ladies and Gentlemen, you see the egg is safely in the box;' then uncovering it again, say, 'Now you shall see me take it out;' and having done so, let one of the company put it into your pocket.

Now open your box again, being careful to remove the two upper parts, and say, 'You see it is empty;' then closing your hand about the middle of the box, and taking off B without C, say, 'Now you see it is here again;' when to all those present it will certainly appear to be the real egg. Then again removing B and C together, show them the empty box, and if you can dexterously convey the egg from the pocket in which it was placed to another pocket, or away from you altogether, you may allow the spectators to convince themselves that you have conjured the egg back into the box, and thus render this interesting trick very complete.

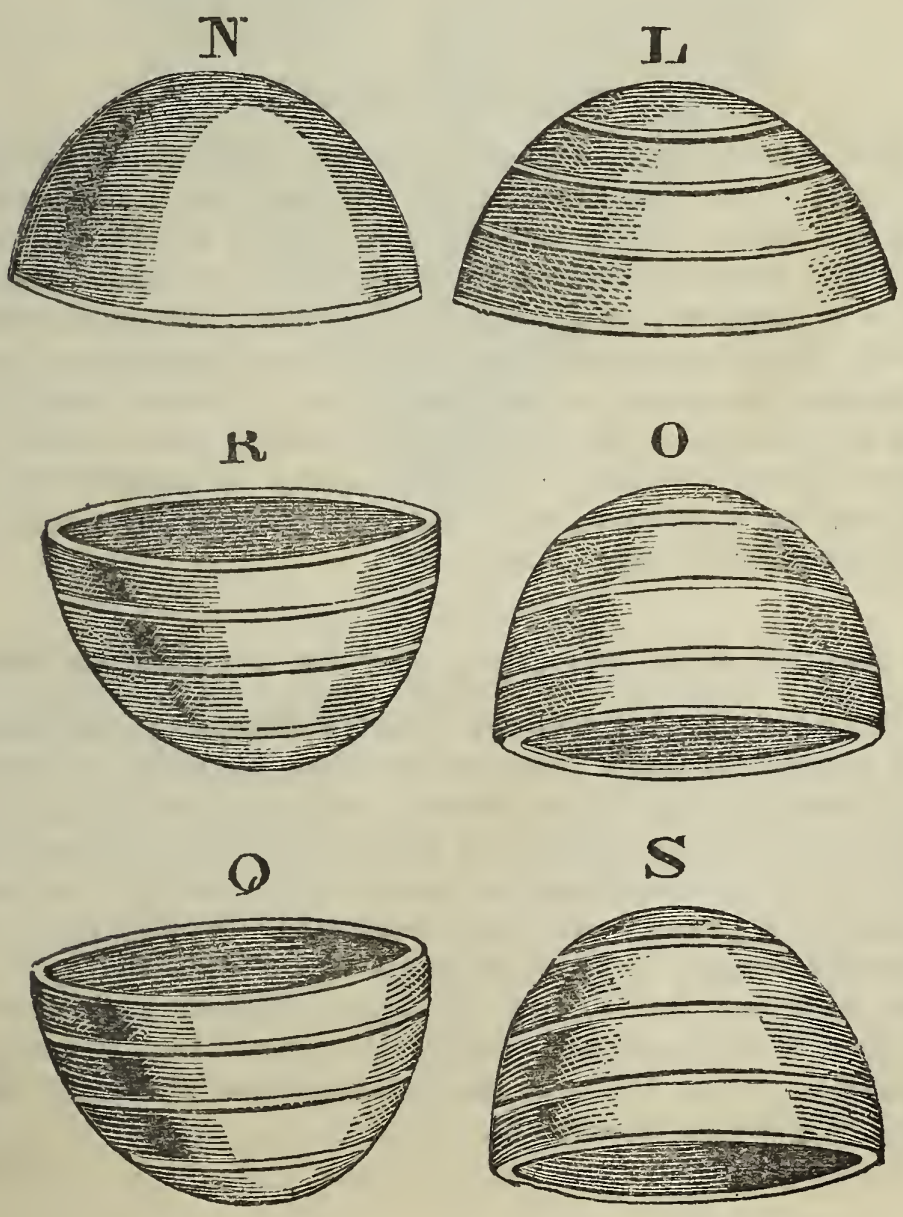


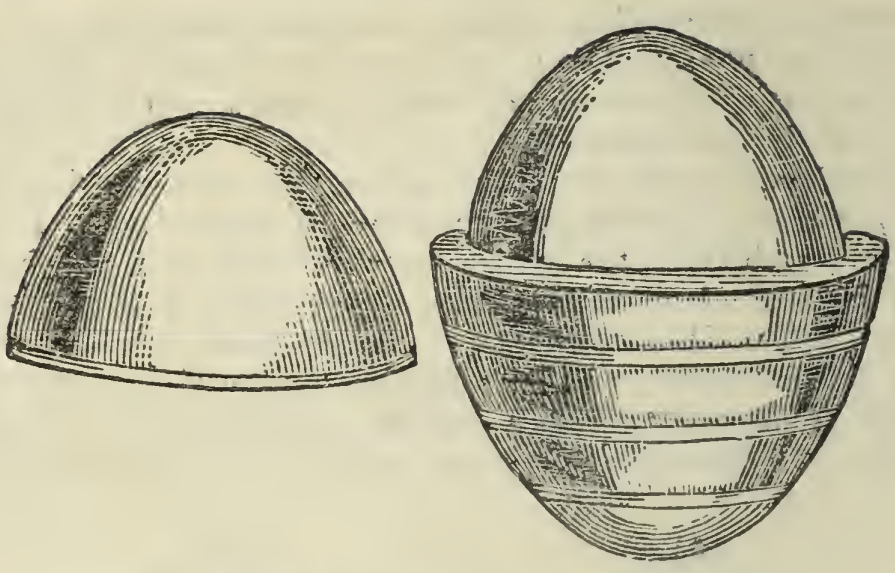
THE GLOBE BOX.

This trick is very similar to that of the Egg-box, differing only in this particular, that, instead of the imitation egg, you have two or three imitation Balls, of different

colours; and by using them in the same manner as described in the egg-box trick, you may appear to change the original ball into one of various colours, and then back again to its primitive white.

The box requisite for performing this trick consists of eight pieces, as shown in the annexed engraving. L is the outer shell of the globe, taken off the cup and ball M; N is an inner shell; O the cover of N; P is another inner shell; Q is its cover; R is the third inner shell, and S is its cover; and it is at the option of the practitioner to have as great a variety of balls as he thinks proper, the principle being the same for one as for twenty.



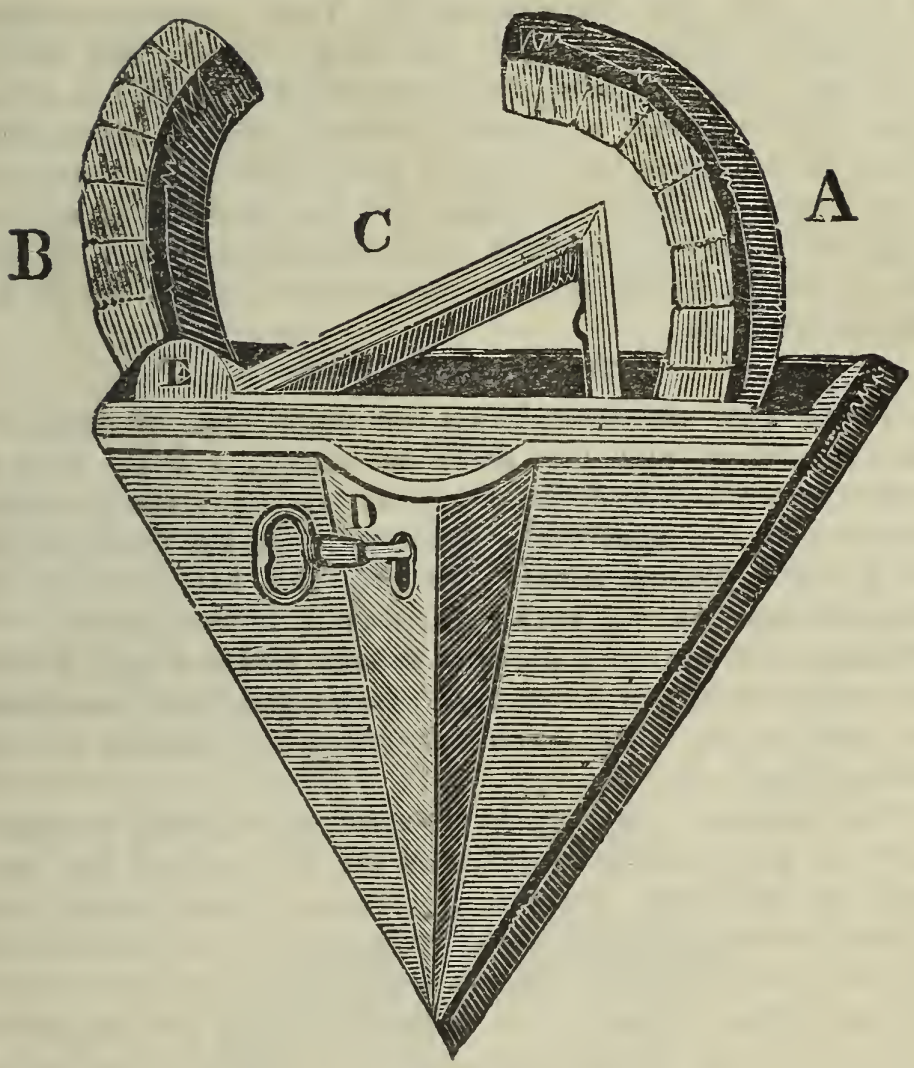


THE WALKING PYRAMID.

Roll a piece of thin paper into the form of an extinguisher; then, unperceived by the company, introduce into it a small beetle or lady bird, either of which will naturally endeavour to escape; the motion which it would make in doing so, would cause the paper pyramid to walk slowly about the table, producing a very grotesque appearance; the more so, as from its being wide at the bottom and narrow at the top, it has a stately look: after it has walked a sufficient time, we should recommend that the trick be explained, which is perhaps as great a source of amusement as the trick itself.

TO MAKE A SHILLING JUMP OUT OF A GLASS OR POT.

Make a small hole through the coin, and passing a horse-hair through it make it fast to the rim; then seat yourself at a table, taking care to place a candle between the pot, which is in front of you, and the spectators; then having dropped the shilling into the glass with your thumb and finger, keep your hands at a considerable distance from it, of course keeping hold of the hair; then begin to tap the table with your finger, and bidding it to come, keep drawing your hand back, and back, until the shilling is out of the glass. This trick, if well managed, is generally the cause of great astonishment.



THE LOCKED JAW.

A lock is made for the purpose of this trick, similar to the cut, as far as its peculiarities are concerned; the side of its bow, marked A., must be a fixture; the other, B, must turn on a pin fastened to the body of the lock, at E, so that it may play to and fro with ease. This side of the bow must have a leg, with two notches filed on the inner side of it, so contrived that one may lock or hold the two sides of the bow as close together as required, and the other notch hold them a proportionable distance asunder; so that, when locked upon the cheek, they may neither pinch too hard, nor yet hold it so slightly that it may be drawn off. Let there be a key, D, to the lock; and, as shown in the engraving, let the bow have several notches filed in it, so that the place of the partition, when the lock

is shut, may not be suspected. Your apparatus being ready, get a person to hold a shilling between his teeth; then take another, and, with your left hand, offer to set it edge wise between a second person's teeth, pretending that your intent is to turn both into which of their mouths they please. This will afford you an opportunity of putting the lock on your cheek unobserved, and you will then immediately, by an exclamation, attract the notice of the spectators to it.

THE DANCING EGG.

Three eggs are brought on the stage; two of them are put on a table, and the third in a hat; a little cane is borrowed from one of the company, and it is shown about to convince the spectators that there is no preparation. It is then placed across the hat, the hat falls to the ground, and the egg sticks to it as if it was glued; the orchestra then plays a piece of music, and the egg, as if it was sensible of the harmony, twists about the cane from one end to the other, and continues its motion till the music stops.

Explanation.—The egg is fastened to a thread by a pin, which is put in lengthways, and the hole, which has been made to introduce the pin, is stopped with white wax. The other end of the thread is fastened to the coat of the person who performs the trick, with a pin bent like a hook; the cane passing under the thread near to the egg serves for it to rest on;—when the music begins, the performer pushes the cane from right to left, or from left to right; it then appears as if the egg ran along the cane, which it does not; being fastened to its thread, its centre of gravity remains always at the same distance from the hook that holds it, and it is the cane which, sliding along, presents its different points to the surface of the egg.

To induce the illusion, and persuade the company that it is the egg which carries itself towards the different points of the cane, the performer should turn a little on his heel; by this means the egg receives a motion which deceives the spectator, it remaining always at the same distance from the point to which it is fastened.

THE HATCHED BIRD.

The preparation of this trick requires much ingenuity. You must divide an egg in the middle, as nearly as pos-

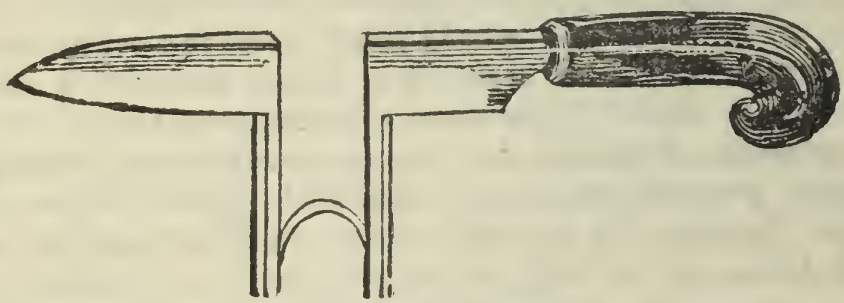
sible; empty it, and then, with a fine piece of paper and a little gum, join the two parts together, having first put a live canary bird inside, which will continue unhurt in it for some time, provided you make a pin hole in the shell to supply it with air; have, also, a whole egg in readiness. Present the two eggs for one to be chosen; put the one which contains the bird next to the person who is to choose, and, for this purpose, be sure to select a lady: she will generally choose the nearest to her, because, having no idea of the trick to be performed there is no apparent reason to take the further one: at any rate, if the wrong one be taken, you need not fail in the trick, for you may break the egg, and say—'You see that this egg is fair and fresh, madam, as you would have found the other, if you had chosen it. Now, would you like to find in it a mouse or a canary-bird?' She naturally declares for the bird; nevertheless, if she ask for the mouse, there are means of escape: you ask the same question of several ladies, and gather the majority of votes, which, in all probability, wil be in favour of the bird, which you can then produce.

THE FUNNEL TRICK.

This instrument must be made for the purpose. It must externally have the appearance of being a common funnel, but within there must be a second funnel, soldered so close to the outer one as not to be detected. Pour a little wine, or other coloured liquid, into the smaller end of

the outer funnel, and turn it up, keeping the wine in by holding the thumb to the end of the funnel. This must be done adroitly, that it may escape notice. Now pour some more wine or liquid into the broad opening of the funnel, and drink it off entirely, turning the broad end downwards, to show that it is all consumed. Then turn yourself about, utter some mystic words, withdraw your finger from the small end of the funnel, and let the wine run out. The opening for its escape should be small, that, from the time of its running, the quantity may be taken to be greater than it is in reality.

THE STABBED WRIST.



To perform this trick, the operator requires two knives. They should be both alike in appearance, as far as the handle, length and width of blade, &c. are concerned; but one of them must have a grove in the middle, like the engraving. Begin the feat by making as much display as possible of the true knife; but at the convenient opportunity, you must pass it into your pocket, and get the false one fixed on your wrist. You will then display your hand and arm, so that the latter will have the appearance of being stabbed through the wrist.

THE MONEY IN THE BOX.

A person is required to hold a box, into which a piece of money or a ring is dropped, so that he and all present can see and hear it. The operator stands at a distance, and bids him shake the box gently, and the piece is heard to rattle inside; he is desired again to shake it, and then it is not heard to rattle; the third time, it is again heard, but the fourth time it is gone, and is found in or near the shoe of one of the company.

A box must be made for the purpose, in such a manner that, in shaking it gently up and down, the piece within is

heard; on the contrary, shaking it hard, horizontally, a little spring, which falls on the piece, prevents it from being heard, which induces you to imagine it is not within. The performer of the trick then touches the box, under pretence of showing how to shake it, and although it is locked, he gets out the piece by means of a secret opening, availing himself of that minute to put in a false piece, and to leave the box with the same person, whom he causes to believe that the piece is or is not within, according to the mode in which the box is shaken: at length the original piece is found in the shoe of one of the company, either by means of the person being in confederacy, and having a similar piece, or by sending another to slip it on the floor: in the latter case, it is found on the floor, and the person fixed on is persuaded that it fell from his shoe as he was taking it off.

THE HANDKERCHIEF MARKED, CUT, TORN, AND MENDED.

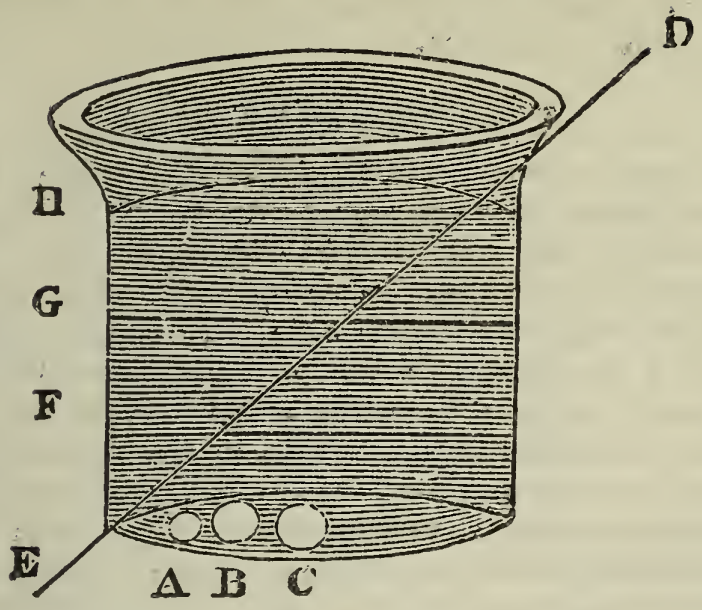
Two of the company are invited to the table of the exhibitor, and a handkerchief is given to them, which they are told to hold by the four corners; afterwards other handkerchiefs are collected from the company, and as they are gathered they are put into the first one, to make a bundle: a third person is then told to take one of them out by chance, to examine the marks, &c., and to cut off a corner with a pair of scissors; other persons may also cut off pieces if they choose, after which the handkerchief is entirely torn to pieces. All the shreds are collected, which, after the show of sprinkling with some more powder, are folded up and tied tight, to press them into a small compass, ostensibly for the purpose of making the trick appear marvellous, but really to facilitate its accomplishment. They are next put under a glass, which the operator will then pretend to warm by rubbing with his hands. In a few minutes the handkerchief is taken from under the glass and unfolded, and the astonished company recognise the marks, but cannot perceive any rent in the handkerchief.

Explanation.—This operation, attractive as it is, is very simple. One of the company is in confederacy, who having two handkerchiefs exactly alike, gives one to another confederate, who is hidden under the table, and throws the other on the stage, to be used in the trick. Care is taken

to put this handkerceief on the top of the heap, although they are seemingly mixed at hazard; the person whom the operator addresses to take one by chance, naturally takes the uppermost, and if you perceive that another is taken you request them to mix them well, under pretence of completing the trick; and then, under pretence of settling them, you regain the position of the confederate handkerchief, and hand the bundle to some other of the company, whose countenance indicates less suspicion, who puts his hand to the bundle of handkerchiefs, and good-naturedly takes out the first. When the handkerchief has been torn and well folded, it is put under a glass on a table, near a partition. On the part of the table where it is placed there is a small trap which opens to let it fall into a drawer; the hidden confederate passes his hand through the table, to substitute the second in place of the first handkerchief; he then shuts the trap, which so neatly fits the space it occupies as to appear one uninterrupted surface.

TO SWALLOW A LONG PUDDING.

This is a famous trick among travelling mountebanks. The pudding must be made of tin, consisting of twelve or thirteen little hoops, round, and little ringlets, so as they may almost seem to fall one through another, having little holes made at the biggest end thereof, that it may not hurt your mouth: hold this pudding, as it is called, privately in your left hand, with the whole end uppermost, and with your right hand take a ball out of your pocket, and say, 'If there be any old woman that is out of conceit of herself, because her neighbours deem her not so young as she would be thought, let her come to me, for this ball is a present remedy.' Then seem to put the ball into your left hand, but let it slip into your lap, and clap your pudding into your mouth, which will be thought to be the ball which you showed them; then decline your head, and open your mouth, and the pudding will slip down at its full length, which, with your right hand, you may strike into your mouth again; doing this three or four times, you may discharge it into your hand, and clap it into your pocket without any suspicion, by making three or four wry faces after it, as though it had stuck in your throat.



THE MAGIC VESSEL.

On the bottom of the vessel lay three pieces of money, the first at A, the second at B, and the third at C. Then place a person at D, where he can see no further into the vessel than E. You tell him, that by pouring water in the vessel you will make him see three different pieces of money; and bid him observe, that you do not convey any money in with the water. But be careful that you pour the water in very gently, or the pieces will move out of their places, and thereby destroy the experiment.

When the water rises up to F, the piece at A will be visible; when it reaches G, both A and B will be visible; and when it comes up to H, all three pieces will be visible.

THE TRANSMUTABLE PIECES.

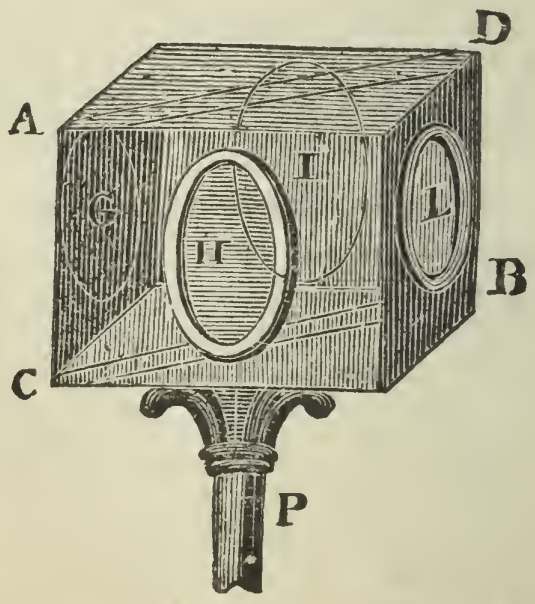
Take two sovereigns and two shillings, and grind part of them away, on one side only, so that they may be but of half the common thickness; and observe, that they must be quite thin at the edge; then rivet a guinea and a shilling together. Lay one of these double pieces, with the shilling upwards, on the palm of your hand, at the bottom of your three first fingers, and lay the other piece with the guinea upwards in the like manner, in the other hand. Let the company take notice in which hand is the guinea, and in which is the shilling. Then, as you shut your

hands, you naturally turn the pieces over, and when you open them again, the shilling and the guinea will appear to have changed places.

THE MAGICIAN'S MIRROR.

Construct a box of wood, of a cubical shape, A B C D, of about fifteen inches every way. Let it be fixed to the pedestal P, at the usual height of a man's head. In each side of this box let there be an opening, of an oval form, ten inches high, and seven wide. In this box place two mirrors, A D, with their backs against each other. Let them cross the box in a diagonal line, and in a vertical position. Decorate the openings in the sides of this box with four oval frames and transparent glasses, and cover each with a curtain so contrived as to all draw up together.

Place four persons in front of the four sides, and at equal distances from the box, and then draw them up, that they may see themselves in the mirrors, when each of them, instead of his own figure, will see that of the person next to him, but who will appear to him to be placed on the opposite side. Their confusion will be the greater, as it will be very difficult, if not impossible, for them to discover the mirrors concealed in the box. The reason of this phenomenon is evident; for though the rays of light may be turned aside by a mirror, yet they always *appear* to proceed in right lines.



THE CONJUROR'S BRIDGE.

This is an amusing operation, that may be effected with three table-knives, three tobacco-pipes, three pieces of stick, or any other light articles of corresponding length. In a domestic circle, it may be prettily shown with three wine-glasses and three knives. Place the three glasses at the corners of a supposed triangle, equi-distant from each other, and nearly as far apart as the length of the knives. Place the handles of two of the knives each on one of the glasses, so that the end of the blades, when brought to the centre of the triangle, will cross each other. Then place the handle of the third knife on the edge of the glass, as you have done the other, but bring the blade of it, not above or below, but between the blades of the two other knives. The result will be, that they will sustain one another so perfectly as to admit of a considerable weight being placed on the centre, without deranging them. The accompanying diagram shows the mode of crossing the articles:—

This feat may be performed with three tobacco-pipes, without the aid of glasses or cups to elevate them, the hollow of the bowl being turned on the table, and thus made the basis to support the bridge formed of the arms of the pipes.

TO SO FILL A GLASS WITH WATER THAT IT CANNOT BE REMOVED WITHOUT SPILLING THE WHOLE.

This is a mere trick, but may afford some amusement. You offer to bet any person that you will so fill a glass with water that he shall not move it off the table without spilling the whole contents. You then fill the glass, and laying a piece of paper or thin card over the top, you dexterously turn the glass upside down on the table, and then drawing away the paper, you leave the water in the glass with its foot upwards. It will therefore be impossible to remove the glass from the table without spilling every drop

THE PENETRATIVE COIN.

This trick requires a nest of boxes made for the purpose, which, however, can be obtained at most of the toy-shops. They consist of a round tin box, of the size of a large snuff-box, and eight smaller boxes, made of the exact size to fit one within the other, the least of them being large enough to hold a shilling. Each of these boxes should shut with a hinge, and to the smallest there must be a small lock, fastened with a spring, but which cannot be opened without a key; and all these boxes must shut so freely, that they may all be closed at once. Place them one within the other, with their tops open, in your pocket: then ask a person for a shilling, and desire him to mark it, that it may not be changed: take this piece in one hand, and in the other have another of the same appearance, and, putting your hand in your pocket, you slip the piece that is marked into the least box, and, shutting them all at once, you take them out: then, showing the piece you have in your hand, and which the company suppose to be the same that was marked, you pretend to make it pass through the box, but dexterously convey it away. You then present the box, for the spectators do not know yet that there are more than one, to any person in company, who, when he opens it, finds another, and another, till he comes to the last, but that he cannot open without the key, which you then give him; and, retiring to a distant part of the room, you tell him to take out the shilling himself, and see if it be the one marked. This trick may be made more surprising by putting the key into the snuff-box of one of the company, which you may do by asking for a pinch of snuff, and, while taking it, introducing the key through your fingers into the box; the key, being very small, will lie concealed among the snuff; and when the person who opens the boxes asks for the key, you may tell him that one of his friends has it in his snuff-box.

TO RE-UNITE CUT LACE, &c.

This requires two corresponding pieces of lace, or ribbon, as the case may be, one of which must be concealed in the hand. Double the other, and introduce the fold between the forefinger and thumb, with the piece previously concealed doubled in the same manner; draw out a small portion of the latter, so as to form a loop, and in-

vite one of the company to cut it asunder. If you have introduced between your thumb and forefinger with sufficient adroitness the privately concealed piece of lace, the spectators will think you have really cut it, which you will now make a show of re-uniting, and getting rid of the two ends of the piece that really have been cut, produce the other entire.

TO FIX A COIN TO A WALL.

Privately notch the rim of the edge of a half-crown, or other coin, in an abrupt way, so that a sharp point of the silver may stick up; take the coin in your hand, and utter some cabalistic words, intimating your will that it shall adhere to the wall on your bidding, and clapping it pretty sharply on the wall, and pressing with your thumb the ragged part you know to be sticking out, it will enter the wood, and thus sustain the coin.

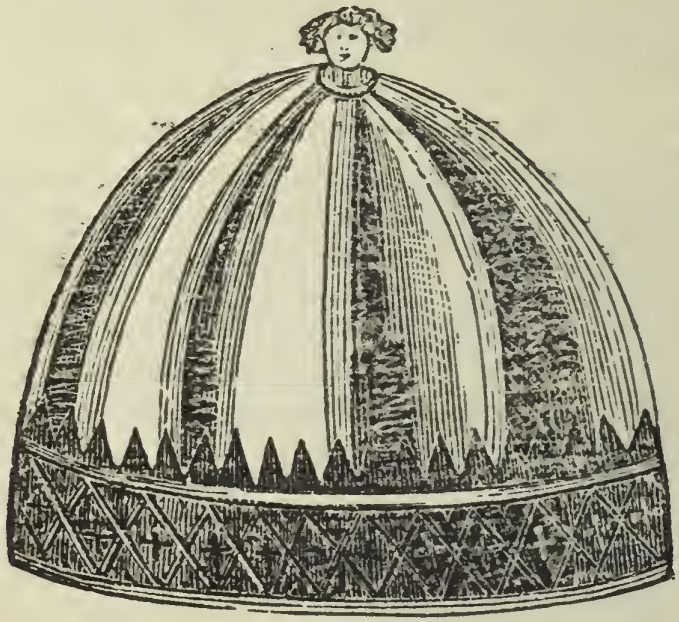
TO PERSUADE A PERSON THAT HE HAS A COIN IN HIS HAND WHEN HE HAS NOT.

Have a little adhessive wax on your thumb in readiness. Show a sixpence to one of the company, and ask him if he is sure he can hold that sixpence so closely in his hand that you cannot abstract it without his knowledge. He will, of course, reply in the affirmative. Then press it hard upon the palm of his hand with your waxed thumb, looking him full in the face, and using some cabalistic terms to occupy his attention. Remove your thumb, and the coin, through the agency of the wax, will adhere to it; close the hand of the party at the same time, and ask him whether he is sure he has got the sixpence safely. Such will be the effect of the pressure of the coin on his hand, that he will have no idea but that it is still there, and will so declare himself. Then tell him to open his hand, and his astonishment at finding that it is gone will be most amusing to the spectators.

SLEIGHT OF WIT NOT SLEIGHT OF HAND.

Hold your arms out at full length, one hand having in it a piece of coin—offer to convey it to the other hand, without throwing it from one to the other, or bringing the hands together. If you have made a wager on the subject, gravely turn your body round, so as to be enabled to lay

the money upon the table, then, with equal seriousness, the arms being still extended, turn round again, until you are able to take up the money with the other hand, and the money is fairly pursed.



THE INVISIBLE COURIER.

The sleight of hand necessary for the performance of this deception is very trifling; the chief art lies in distracting the attention of the spectator while the trick is in progress: this is effected by what is vulgarly called *spinning a yarn*, a faculty possessed in high perfection by many persons never suspected of being conjurors. Being easy of performance, it was formerly a favourite trick with mountebanks, who amused their listeners by means of this or some other deception while they were putting off their *invaluable* medicines. To illustrate the subject let us suppose some German quack is recommending his *infallible balm of elephantis*, which can cure all disorders to which mankind is subject, those which are incurable most readily giving way to the powers of the medicine; after praising the article in which he deals, he suddenly takes out of his pocket a little wooden doll, and says—

'Ladies and Gentelmans—Dis is my invisible coureur, which I do send on all my most imbortant errands. He is so discreet a gommissionare he never divolge one wort of de secret which I confide to him. He is a most oninter-

ested servant, and never ask his master for wages. No one would sospect him to be a spy—he is welcome in all gombanies, and every body gonsiders he is deaf and gan't zee.'

Our worthy quack then apostrophises the doll as follows:—

'Ah! ah! Measter Jean, I most send you to Durham to boy some mostard, and you most gall, as you go by, at Vindsor, and you most kiss de Princess Royal, and tell me whether she sleep well last night.'

Our conjuror now places the doll to his ear, to see if it has any observation to make, and placing it again on the table, says—

'Ah! you are quite right to ask for your silk gown; you will meet with many boliteness from those people who jodge by abbearances, and who respect a man for his goat.'

Again the doll is placed to the performer's ear, and again his master observes—

'Dat is well said; I onderstond you; I know dat a travellar without de argent is loike a vire without coals, or a boet without a grain of folly.'

He then conveys his hand twice from his pocket to the doll, observing—

'If you see noting, ladies, you most not be sarprised; my coureur is invisible when he travels, and I give Master Jean invisible money.'

At the same time he turns up the dress of the doll, and shows it is gone; and, to prove it really is not there, rolls up the dress in his hands into the compass of a ball.

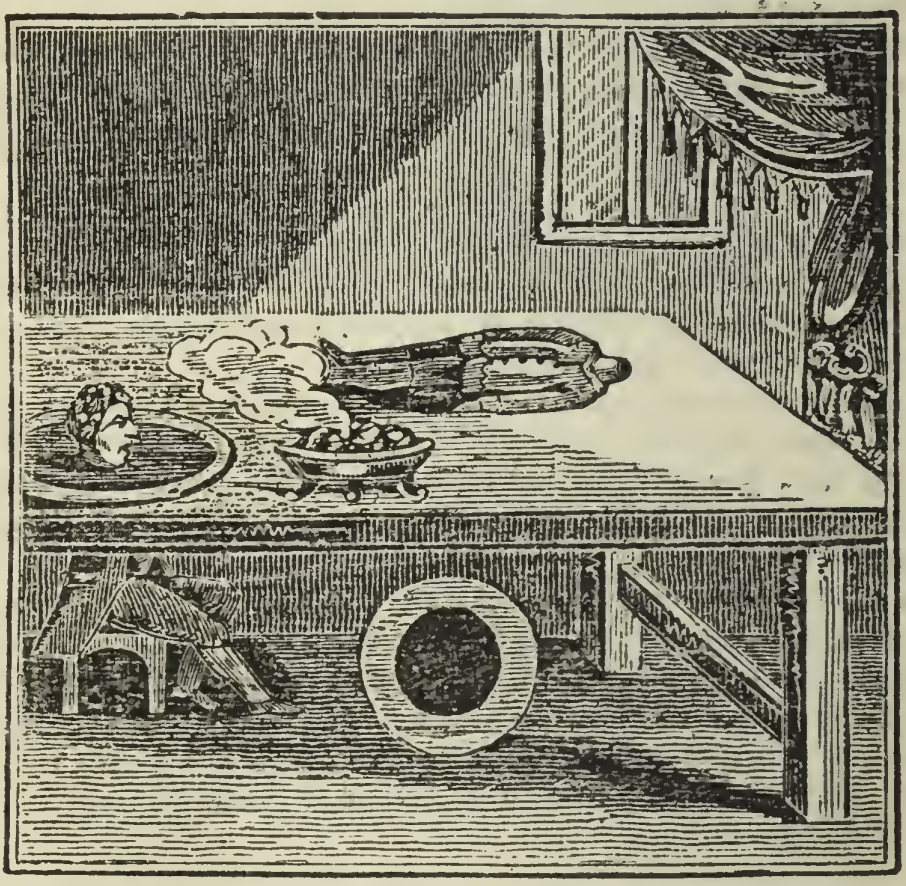
Expatiating then upon the value of his medicine with great volubility, he suddenly breaks off in the midst of his harangue, and pointing to the roof of the opposite house, exclaims—

'*Oh! Donder* and *Blitzen*, you are von great rascal!' Every body turns and looks in the direction towards which the juggler's eyes are directed, but are unable to see any thing; the doctor still continues to talk by signs; at last, he lets his listeners know that *Measter Jean* is scrambling along the roof of the house.

'Oh, you villain!' he cries, what, you are tearing your new shirt instead of going to Durham for me; gome down, you rascal, or I will magnetise you;' and sure

enough, when the dress, which has lain upon the table, is examined, Master Jean is found to have returned

The secret of this simple trick is as follows:—The doll is made of three pieces, the head forming one the body to the waist a second, and the legs and hips a third piece. To the under part of the two upper pieces a peg is fixed, which fits a hole in the next piece sufficiently tight to prevent its falling off by its own weight. These pieces are conveyed away separately without suspicion when money is supposed to be given to the doll, and replaced, without fear of detection, while the attention of the company is attracted towards the roof of the house.



TO EXHIBIT A MAN'S HEAD IN A DISH AS IF CUT OFF.

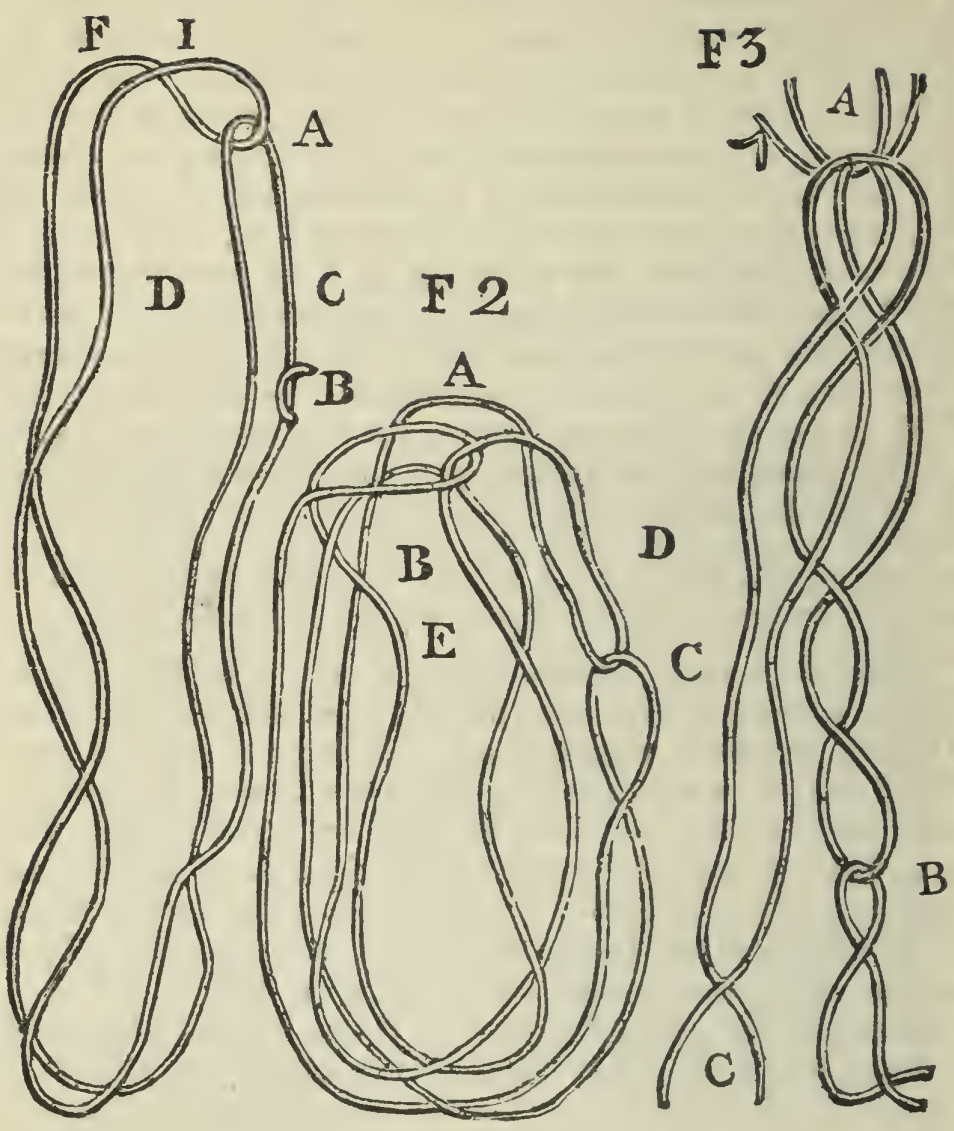
Have a table, properly prepared with two holes in it sufficiently large to allow a boy's head to pass through. The table must be covered with green baize reaching to the ground. In this deception you require two boys as confederates: one must be seated on a low stool of sufficient height to enable his head to pass through one of the

holes in the taole. A large wooden platter, with a hole in it. is placed over his head, which may be thrown backwards. with the face uppermost, and the mouth half open. The plate should be sprinkled with blood, so as to help the deception, and a chafing-dish with live coals placed close by, on which brimstone or theatrical *blue fire* may be thrown: this gives the head a ghastly hue. The second boy is laid flat upon the table, his back uppermost. and his head bent forward and passed through the other hole in the table; the part of his neck that is visible being smeared with blood, to make it resemble a decapitated trunk This is a trick seldom exhibited, for the sight is any thing but pleasant, and the trouble far exceeds any gratification it is capable of yielding.

TO APPEAR TO CUT A PIECE OF TAPE INTO FOUR PARTS, AND TO MAKE IT WHOLE AGAIN.

Take a piece of narrow tape about two or three yards long; show it to any one who may wish to look at it; then tie both the ends together, and holding the tape on your hand as you would a skein of silk, twist it once, by turning one hand towards you and the other from you; if now you pass both the looped ends or bights of the tape on to one hand, the tape will be as seen in figure 1, taking care so to arrange it that the knot shall be about halfway down, as at B. Then again taking the double tape, as in figure 1, in both hands, as you did the single before, turn it round, and place both looped ends again upon one hand; it will then appear as in figure 2. Then take the second twist A and the knot B between the forefinger and thumb of your left hand, and the first twist C between the forefinger and thumb of your right hand, and desire some one to cut all asunder at E D.

When it is cut, hold your left hand still, and unloosing your right hand, let all the ends fall; it will now seem as if there were eight ends, namely—four above and four below, and the tape will seem to have been cut into eight parts, as in figure 3. Then gather up the ends you let fall, and place them in your left hand, and offer the two ends C to some person to hold, selecting them, apparently, at random; desire the party to hold D, and by dexterously rolling the tape about in your fingers, contrive to remove the short pieces A and B, and conceal them. Now roll the whole of the tape up into a confused mass, place it in the hands of



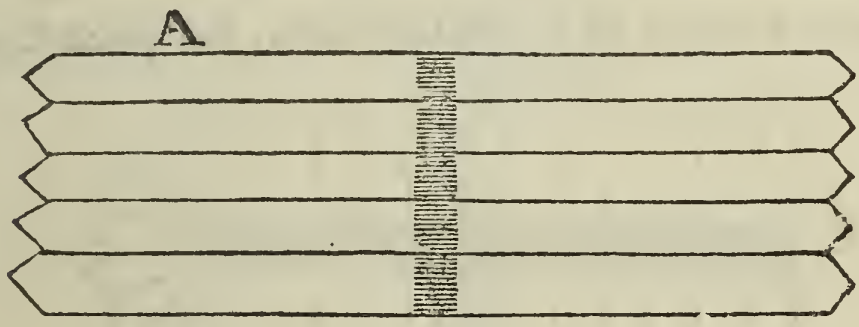
any one present, and bid them hold it firmly. While all are attending to the event, the short pieces may be got rid of. If now the tape is examined, it will, of course, be found to be in one piece. An ancient writer on legerdemain says, quaintly, 'It is an excellent trick if it be gracefully handled, and a trick that cost me more trouble to find than all the rest; this I have gone purposelie to observe, but returned as wise as I went.'

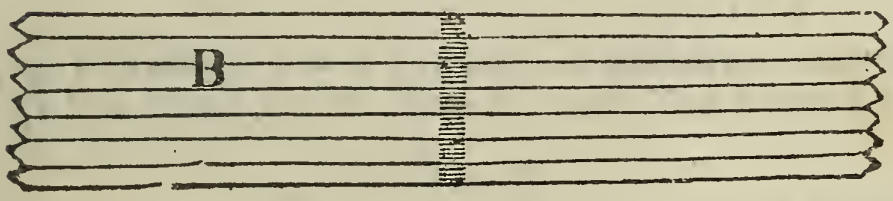
PUZZLE WIT.

Most of our readers, we presume, have seen a man about the streets producing the likeness of a multitude of articles through the transmogrifications of a piece of folded

paper. It certainly requires an imaginative turn, on the part of the exhibitor, and a fair portion of good-nature on that of the spectator, to be satisfied with the similitude of some of the articles announced; but of the ingenuity of the exhibition there can be no doubt. Like most things of the kind, it is extremely simple to the initiated, and we therefore give instructions for preparing the paper, in the confidence that, with a little practice, any of our juvenile readers will readily acquire the tact of forming figures with it, even in greater variety and completeness than the poor blind fellow whose ingenuity enabled him to get a living by their exhibition.

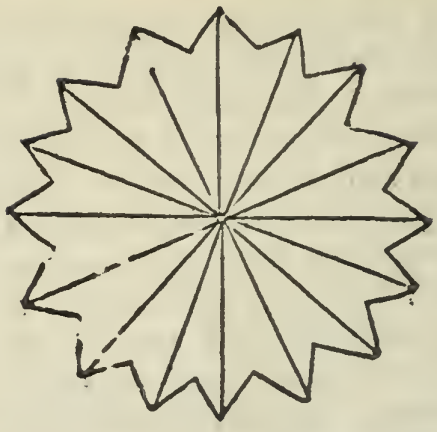
Take a sheet of good stiff cartridge-paper; fold it through the middle, longways; turn down the edge of each fold outward, to the breadth of a penny; measure it, when folded, into three equal parts, with compasses, thus making six divisions in the sheet; let each third part be turned outward, and the other, of course, will fall right; then pinch it a quarter of an inch deep, in plaits, like a ruff; so that, when the paper lies pinched in its form, it will be in the fashion represented by A; when closed together, it will be like B.





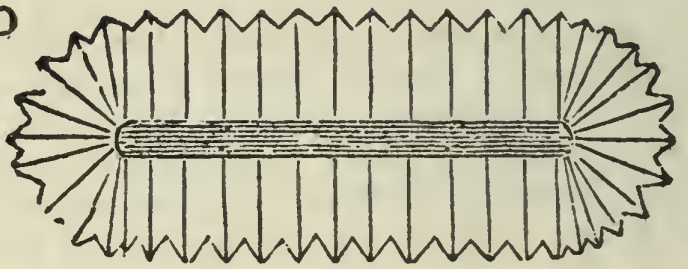
Unclose it, shuffle it with each hand, and it will resemble the shuffling of a pack of cards; close it, and turn each corner inward with your fore-finger and thumb; then it will appear like a rosette for a lady's shoe, as C; stretch

C



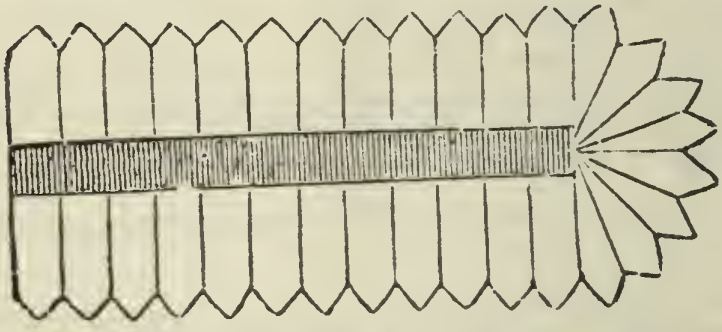
it forth, and it will resemble a cover for an Italian couch, as D; let go your fore finger at the lower end, and it will

D



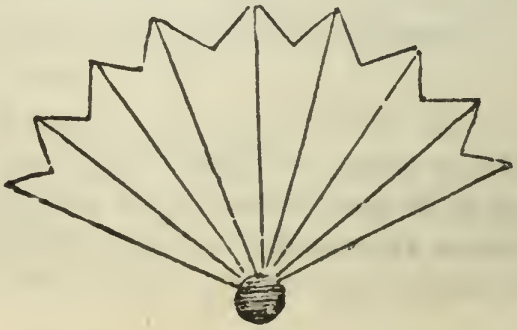
resemble a wicket, as E; close it again, and pinch it at

E

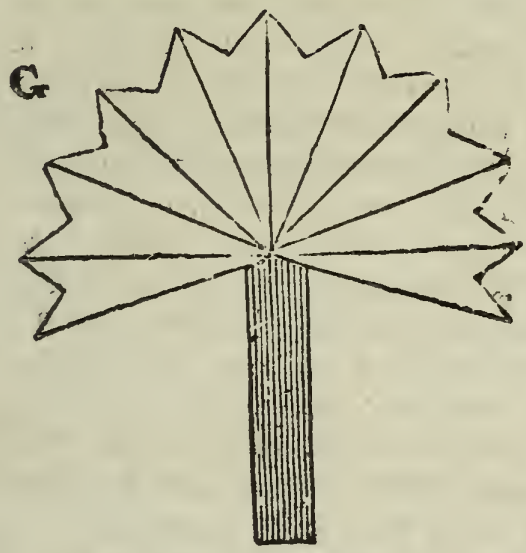


the bottom, spreading the top, and it will represent a fan, as F; pinch it half way, and open the top, and it will ap-

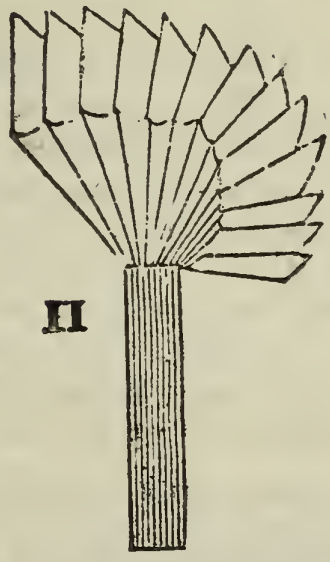
F



pear in the form shown by G; hold it in that form, and



with the thumb of your left hand turn out the next fold, and it will be as H.



And thus, with a little ingenuity and practice, Puzzle-wit may be made to assume an infinite variety of forms, and be productive of very considerable amusement.

THE WONDERFUL WAFERS.

On each side of a table knife, place, in the presence of your company, three wafers. Take the knife by the handle, and turn it over two or three times, to show that the wafers are all on. Desire some person to take off one wafer from one side of the blade; turn the knife two or three times again, and there will appear only two wafer

on each side; remove another wafer, turn the knife as before, and there will appear only one wafer on each side; take the third wafer away, turn the knife as before twice or thrice, and there will appear to be no wafer on either side. After a momentary pause, turn the knife again two or three times, and three wafers will appear on each side.

The secret of this capital trick consists in using wafers of the same size and colour, and turning the knife, so that the same side is constantly presented to the view, and the wafers are taken off that side, one by one. The three wafers thus remain untouched on the other side, so that when you have first made it appear that there are no wafers on either side, you may, apparently, show three on each by the same means.—The way to turn the knife is as follows: when you lift it up, turn it in your hand, with your finger and thumb, completely round, until the side that was uppermost when you lifted it, come uppermost again. This is done in an instant, and is not perceptible, if adroitly managed.

THE MYSTERIOUS BOTTLE.

Pierce a few holes, with a glazier's diamond, in a common black bottle; place it in a vase or jug of water, so that the neck only is above the surface. Then, with a funnel, fill the bottle, and cork it well, while it is in the jug or vase. Take it out, and, notwithstanding the holes in the bottom, it will not leak; wipe it dry, and give it to some person to uncork. The moment the cork is drawn, to the party's astonishment, the water will begin to run out of the bottom of the bottle.

THE BOGLE BODKIN.

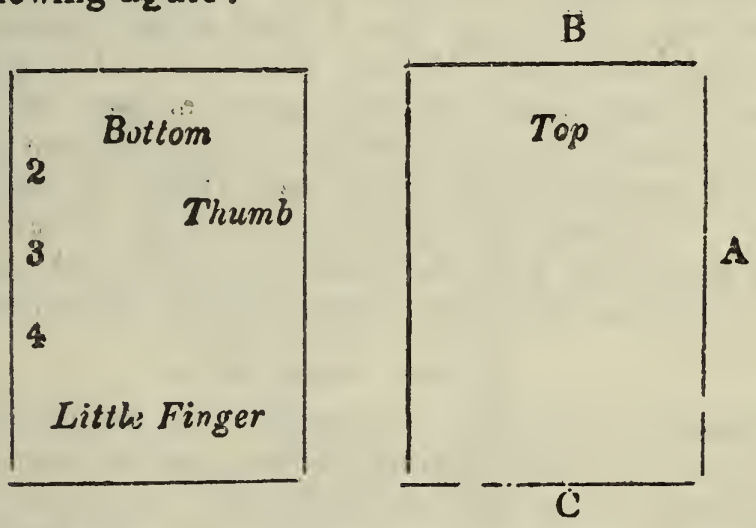
Make a hollow bodkin, (or, if you prefer it, a dagger,) so that the blade may slip into the handle as soon as the point is held upward. Seem to thrust it into your forehead (or, if a dagger, into your bosom); then, after showing some appearance of pain, pull away your hand suddenly, holding the point downward, and it will fall out, and appear not to have been thrust into the haft; but, immediately afterward, throw the bodkin, or dagger, into your lap or pocket, and pull out another plain one like it, which will completely deceive the spectators.

TRICKS WITH CARDS.

As in this branch of the ingenious art of Conjuring, we shall often have occasion to desire our young friends to *make the pass*, we shall commence by describing the operation:

HOW TO MAKE THE PASS.

Hold the pack of cards in your right hand, so that the palm of your hand may be under the cards: place the thumb of that hand on one side of the pack; the first, second, and third, fingers on the other side, and your little finger between those cards that are to be brought to the top, and the rest of the pack. Then place your left hand over the cards in such a manner that the thumb may be at C, the fore-finger at A, and the other fingers at B, as in the following figure:—



The hands and the two parts of the cards being thus disposed, you draw off the lower cards, confined by the little finger and the other parts of the right hand, and place them, with an imperceptible motion, on the top of the pack.

But before you attempt any of the tricks that depend on making the pass, you must have great practice, and be able to perform it so dexterously and expeditiously, that the eye cannot detect the movement of the hand; or you may, instead of deceiving others, expose yourself.

FORCING.

Having acquired the *pass*, the next point for the practitioner of legerdemain to acquire, is *Forcing*,—that is,

making a person take such a card as will suit the purpose of the operator, while he supposes he is selecting one according to his inclination or at hazard. The success of many of the best feats depends on cleverness in forcing; and yet it is difficult to describe how it should be done, so much does it depend on intuitive shrewdness. First, determine on the card you intend to force the party to draw; then place it on the pack, and with apparent carelessness proceed to shuffle the cards, taking care, however, either to keep the little finger on the selected card, or to so follow it with the eye that you cannot be mistaken in its identity. This sufficiently exhibited, request one of the company to draw a card; in presenting the pack, open the cards nimbly, spreading them backward and forward, so as to puzzle the eye of the person choosing. The moment he extends his hand to make his choice, spread the cards until you expose the one you wish him to choose, contriving that it shall stand prominently forward at the moment he puts his hand to the pack. Unless the party knows something of forcing, he is almost sure to draw the card desired. You will then tell him to take particular notice of it; and to put it back into the pack. You may turn your back to him while he does so, and then give him the pack to shuffle, for, do what he will, you can, of course, always tell the drawn card.

THE LONG CARD.

Another stratagem, connected with the performance of many of the following tricks, is what is termed the long card; that is, a card either a trifle longer or wider than the other cards, not perceptible to the eye of the spectator, but easily to be distinguished by the touch of the operator.

SEVERAL CARDS BEING SHOWN TO DIFFERENT PERSONS IN ORDER THAT EACH OF THEM MAY CHOOSE ONE, TO NAME THAT WHICH EACH PERSON HAS FIXED ON.

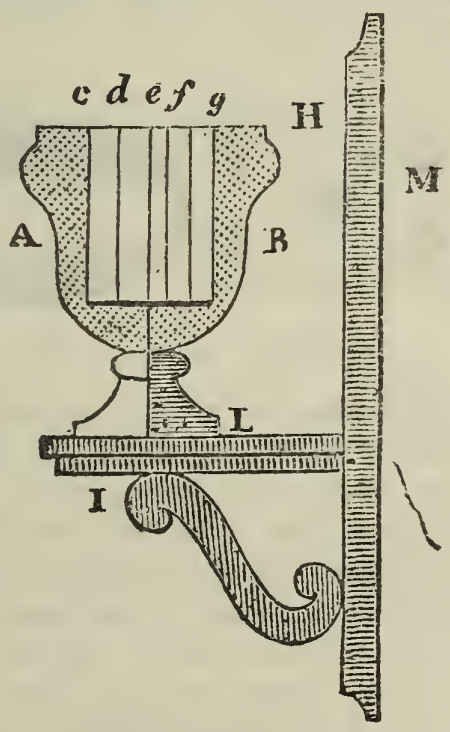
There must be as many different cards shown to each person as there are persons to choose; so that, if there be three persons, you must show to each of them three cards; and, telling the first to retain one of them in his memory, you then lay those three cards down, and show three others to the second person; and so to the third.

This being done, take up the first person's cards, and

lay them down one by one, separately, with their faces uppermost. You next place the second person's cards over those of the first; and, in like manner, the third person's cards over those of the second; so that in each parcel there may be one card belonging to each person.

Having done this, ask each of them in which parcel his card is, and when he has informed you, you may immediately know which card it is; for the first person's card will always be the bottom one, the second person's the middle card, and the third person's the uppermost one, in that parcel where they each say their card is.

This recreation may be performed with a single person, by letting him fix on three, four, or more cards; in which case you must show him as many parcels as he is to choose cards, and every parcel must consist of that number, out of which he must fix on one; the rest of the process being then as above.



THE MAGIC VASE.

Construct a vase of wood or pasteboard. On the inside let there be five divisions; two of them, *c*, *d*, to be large enough to admit a pack of cards each; and the other three, *e f g*, only large enough to contain a single card. Place this vase on a bracket, L, which is fastened to the partition, M. Fix a silken thread at H, the other end of

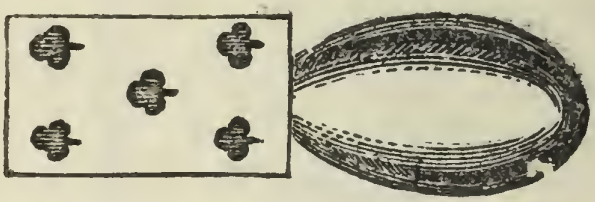
which passes down the division *d*, over the pulley I, runs along the bracket L, and goes out behind the partition M.

Take three cards from a picquet pack, and place one of them in each of the divisions, *e f g*, making the silk thread or line go under each of them. In the division *c* put the remainder of the pack.

You then get another pack of cards, at the top of which are to be three cards, the same as those in the three small divisions; and, making the pass, bring them to the middle of the pack. Let them be drawn by three persons; let them shuffle all the cards; after which place the pack in the division *d*, and tell the parties that the cards they drew will rise at their command, separately, from the vase.

A confederate behind the partition then gently drawing the line, the three cards will gradually appear from the vase; then taking the cards from *c*, you show that those three are gone from the pack.

The vase must be placed so high that the company cannot see the inside.



THE CARD IN THE EGG.

Take a card, the same as your long card, and rolling it up very close, put it in an egg-shell, by making a hole as small as possible, and which you are to fill up carefully with white wax. You then offer the long card to be drawn, and when it is replaced in the pack you shuffle the cards several times, giving the egg to the person who drew the card, and while he is breaking it, you privately withdraw the long card, that it may appear, upon examining the cards, to have gone from the pack into the egg. This may be rendered more surprising by having several eggs, with a card of the same sort placed in each, and then giving the person the liberty to choose which egg he thinks fit.

This deception may be still further diversified, by having, as most public performers have, a confederate, who is previously to know the egg in which the card is placed; for you may then break the other eggs, and show that the

only one that contains a card is that in which you directed it to be.

TO DISCOVER A CARD BY ITS WEIGHT OR SMELL.

Desire any person in company to draw a card from the pack, and when he has looked at it, to return it you with the face downwards; then, pretending to weigh it nicely, take notice of any particular mark on the back of the card, which having done, put it among the rest of the cards, and desire the person to shuffle them as much as he pleases; then, giving you the pack, you pretend to weigh each card as before, and proceed in this manner till you have displayed the card he has chosen.

TO MAKE A PERSON CHOOSE ANY CARD YOU PLEASE.

Spread a pack of cards before any person in company in such a manner, that one of the pictured cards, or some other remarkable one, only shall be completely visible; then desire him to think of any card he pleases; and when he has made his choice, you may safely tell him, that the pictured card is the one he thought on; for, as no other could strike his eye, it was scarcely possible for him to make a different choice; but if he should, you may pretend to have made some mistake, and, after a time, try the experiment with some other person in company.

THE DIVINING CARD.

Provide a pack in which there is a *long card:* open it at that part where the long card is, and present the pack to a person in such a manner that he will naturally draw that card. After telling him to put it into any part of the pack, you shuffle the cards. Then take the pack, and offer the same card in like manner to a second or third person, taking care that they do not stand near enough to see the card each draws.

Then draw several cards yourself, among which is the long card, and ask each of the parties if his card be among those cards, and he will naturally say *yes*, as they have all drawn the same card. You then shuffle all the cards together, and cutting them at the long card, you hold it before the first person, so that the others may not see it, and tell him that is his card. Return it into the pack, *shuffle* and *cut* the pack again at the same card, and hold it to the second person, and so of the rest.

You can perform this recreation without the long card, in the following manner:

Let a person draw any card, and replace it in the pack. You then *make the pass*, already described, and bring that card to the top of the pack, and shuffle them, without losing sight of that card. Then offer the same card to a second person, that he may draw it, and put it in the middle of the pack. You *make the pass*, and shuffle the cards a second time in the same manner, and offer the card to a third person, and so again to a fourth or fifth.

TO DISCOVER THE NUMBER OF POINTS ON ANY THREE CARDS, WHICH A PERSON HAS TAKEN PRIVATELY FROM A WHOLE PACK.

You begin with premising, arbitrarily, that *the ace*, in this case, shall count for *eleven*, but the court cards (as 10, and others) to be counted as usual. Then propose to any person to choose three cards out of the pack, and to place over each of them as many other cards as will make the whole number of points 15.

After this, take the remainder of the pack in your hand; and, under pretence of looking for some particular card among them, count how many there are, and by adding *sixteen* to that number, you will have the number of pips on the three bottom cards.

FOR EXAMPLE:—

Suppose the person had chosen a 7, a 10, and an ace.

Then over the 7, he must place 8 cards; over the 10, 5; and over the ace, 4.

After this he gives you the remaining part of the pack, which you find consists of 32 cards.

From this 32, therefore, you deduct 4, and the remainder 28 is the number of pips upon all the bottom cards.

THE CONVERTIBLE ACES.

1. Having, by means of a little soap, caused the cards to stick together,—suppose an ace of hearts upon the ace of spades, and an ace of spades upon the ace of hearts, the trick may be commenced by declaring an intention of making the spade and the heart change places. For this purpose, one of the double cards is to be placed ceremoniously underneath the foot of a person, or in his pocket, and the other double card seemingly in the pocket of another person; but, in so doing, the *upper card*

of each suit may be readily withdrawn if the performer is adroit enough to keep the parties in discourse, and by looking steadfastly in the face of the individuals upon whom he is practising the trick, they are almost certain to gaze at him in return, instead of watching the manœuvres of his hands.

2. A deception similar to this may be practised with one card—say, the ace of spades, over which a heart is lightly affixed, as in the first trick. After showing a person the card, let him take hold of one end of it; hold the other end yourself, and, while you amuse him with discourse, slide off the heart. Then laying the other card on the table, desire him to cover it with his hand; strike the table, command the heart to turn into the ace of spades, and, on the removal of the hand, the spectators will be wonder-struck at the apparent realization of the command.

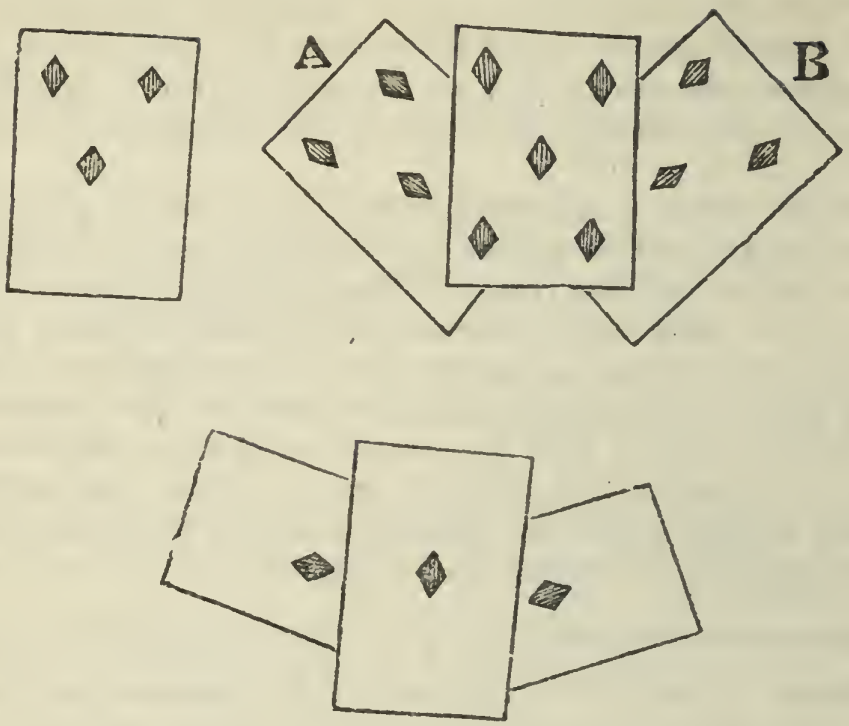
TO DISCOVER A DRAWN CARD BY THE THROW OF A DIE.

Prepare a pack of Cards, in which there are only six sorts of cards. Dispose these cards in such manner that each of the six different cards shall follow each other, and let the last of each suite be a long card. The cards being thus disposed it follows, that if you divide them into six parcels, by cutting at each of the long cards, those parcels will all consist of similar cards.

Let a person draw a card from the pack, and let him replace it in the parcel from whence it was drawn, by dexterously offering that part. Cut the cards several times, so that a long card be always at bottom. Divide the cards in this manner into six heaps, and giving a die to the person who drew the card, tell him that the point he throws shall indicate the parcel in which is the card he drew; then take up that parcel and show him the card.

TO SEPARATE THE TWO COLOURS OF A PACK OF CARDS BY ONE CUT.

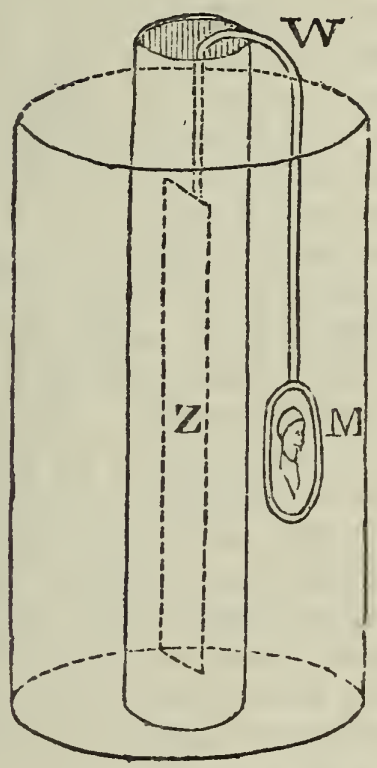
To perform this amusement, all the cards of one colour must be cut something narrower at one end than the other. You show the cards, and give them to any one that he may shuffle them; then holding them between your hands, one hand being at each extremity, with one motion you separate the hearts and diamonds from the spades and clubs.



TO CHANGE FIVES OF DIAMONDS INTO ACES; AND VICE VERSA.

Take two fives of diamonds, and remove two of the spots from each, as in figure 1; place a perfect five on the top of the two altered cards, and spreading them, as in figure 2, they will appear like three fives, for the two spots which have been removed will, of course, be supposed to be only hidden by the upper card. Beneath the lowest of the mutilated fives an ace of diamonds has been concealed; the cards are packed, turned round, and the ace, by a dexterous pretended shuffle, passed from the bottom to the top of the pack of four cards; they are now again spread as in figure 3, and two of the spots of the mutilated cards being hidden by the upper cards, and the five concealed by the real ace, the pack will appear to consist of three aces—and this trick may be as easily reversed by changing the aces again into fives.

SCIENTIFIC RECREATIONS.



THE PROCESS OF ELECTROTYPE.

It was about the year 1839 that the process called Electrotype was brought under the notice of the public. Before that time, although it was known that one of the poles of a galvanic battery had the power of reducing metals from their solution, it had never occurred to the mind of any one to apply that power to its present use—namely, the producing copies in metal of any required object when placed in such a situation as to be acted on by the voltaic or electric power.

The simplest plan of producing the copy of a medal is the following:—Procure a glass or earthenware jar, resembling the larger vessel shown in the engraving. The small cylinder placed within this jar is porous, and may be made of plaster of Paris; but cylinders of this kind are to be had now of almost any optician, formed of biscuit porcelain, or that kind of clay used in making wine-coolers.

Z is a flat piece of zinc, having that side which is furthest from the medal M, which is to be copied, covered with sealing-wax varnish; the wire also may be covered with the varnish as far as W; the other side, having been first wetted with dilute sulphuric acid, is rubbed over with mercury until a thin coat of an amalgam of mercury and zinc is formed on its surface. The zinc is connected by means of a copper wire, to which it is soldered to the mould M. A cast having been taken in bee's-wax of the medal of which a copy is required, the end of the wire W is slightly heated, and being applied to the back of the waxen cast, adheres to it when cold.

Finely powdered black-lead is now rubbed over the face of the cast, and also on so much of the edge of the wax as will continue the coating of black-lead until it reaches the wire.

Now fill the inner porous cylinder with one part sulphuric acid, and ten parts water. Fill the jar also with a saturated solution of sulphate of copper (*blue stone*). Voltaic action then commences: a current of electricity passes from the zinc to the mould, and the copper contained in the solution of sulphate of copper in the jar is deposited in a metallic form upon the mould M. This process is necessarily slow, but in the course of about twenty-four hours a sufficient quantity of copper will have been deposited to allow the copy to be removed.

THE DAGUERREOTYPE.

The wonderful discoveries of Messrs. Neipce and Daguerre, by which we are enabled to fix the image formed by the lens of a camera obscura,* appear, at first sight, to be so far beyond the bounds of probability, that when the invention was announced, the scientific world was completely puzzled as to the meaning to be attached to the words of the announcement; and yet what was declared to have been accomplished was strictly and literally true: the image formed by the rays of light passing through the lens of a camera obscura are absolutely fixed so as to form a picture of the object represented by the process of daguerreotype.

We shall pass by the original process of M. Neipce, who first directed his attention to the subject, because the subsequent discoveries of M. Daguerre completely threw them into the background, although, no doubt, the merit of the original discovery is due to M. Neipce, senr.

* This instrument is described on page 186.

The process of Daguerre is as follows :—a piece of copper covered with silver is procured, and its surface being perfectly polished, and freed from oxide or grease by means of dilute acid, polishing powders and whiting are placed, with the silvered side downwards, in a box containing iodine; if the temperature of the air is as high as 65, no artificial heat is necessary; if not, the box must be placed near to, but not close by, a fire.

The moderate heat thus obtained is sufficient to cause the iodine to rise slowly in the form of vapour. Now iodine, in this state, readily combines with the silver, and forms upon the silvered plate a very thin coating of iodine of silver of a bright primrose colour.

Iodide of silver is easily acted upon by light, and if its action is properly understood, the light partially reduces a portion of the iodide of silver into the form of *metallic* silver. The more powerful the light, the further the process of reduction is carried. One singular part of the process is this, that although the iodide of silver has been thus acted on by the rays of light which have passed through the lens, and acted upon exactly in proportion to the brightness of those rays, there is no appearance of any alteration in the colour of the yellow iodide. The effects of this action are only shown in a subsequent part of the process; the chief difficulty in this part of the business is the knowing the exact time when it is proper to remove the plate from the camera, and as this depends almost entirely upon the clearness of the atmosphere and the power the object to be copied has of reflecting the sun's rays, this difficulty can only be overcome by practice and experience.

Supposing the plate to have been exposed for a sufficient time to the action of the light—from five minutes to a quarter of an hour is usually sufficient—it is now ready for the next part of the process, which is as follows:—

A wooden box is prepared, and at the bottom of this box a vessel containing mercury is placed; the plate we have already prepared is placed with the side on which the coating of iodide of silver is formed, downwards, that is, forming as it were a roof to the box, at the bottom of which is the vessel containing the mercury. A spirit lamp is placed under the mercury, and the latter soon begins to rise, in a state of vapour. That portion of the iodide of

silver which has been acted on by the light in a greater or less degree, is, in the same proportion, acted on by the mercury: that is, the mercurial fumes amalgamate themselves with the reduced silver exactly in proportion to the more or less perfect reduction of the silver. From this it results that those parts of the picture, as we may now call it, which have been most powerfully acted on by the light, have combined with a greater portion of the mercury. The effect of this is, that where the mercury is combined with the reduced silver, the surface of the plate appears white or gray, according to the extent to which the process of reduction has been carried. The plate, if now examined, will show all the lights of the picture, which are represented by the minute bubbles of mercury partially combined with the reduced silver; but the rest of the plate, which ought to stand in the place of the shadows, is still covered with a yellow oxide of silver.

To perfect the process, it is necessary to remove this yellow coating: there are several ways of effecting this purpose—1st, dip the plate in a strong solution of salt in hot water, and afterwards pour distilled water over the surface until the yellow coating is removed.

Or, dip the plate in a weak solution of hypo-sulphite o potash, and afterwards pour distilled water over it as before.

But the neatest plan is the following:—place the plate in an earthenware dish, and cover it with strong brine. Take a piece of zinc and scrape a part of its surface until it is bright; apply this bright surface to one corner of the plate; a current of electricity will immediately pass from the silver to the zinc—the iodide of silver will be reduced, and the yellow coating will disappear.

PHOTOGENIC DRAWING.

This mode of obtaining copies of different objects by means of the sun's rays, was first brought into notice by an English gentleman named Talbort, while the scientific world were excited by curiosity respecting the process of M. Daguerre.

It was long known that a solution of nitrate of silver, when spread upon paper, became blackened when exposed to the sun's rays; consequently, if any object was laid upon paper thus prepared, the sun's light would darken that part of the paper not protected by it, leaving the

other portion of the paper white; in this manner an image of the boject would be obtained, showing white upon a dark ground.

These facts being known, after many experiments, Mr. Talbot succeeded in rendering paper peculiarly sensitive to the action of light; his process differs little from the following, which we recommend to our readers:—

Take the best yellow wove writing-paper—dissolve salt in water so as to make the water pleasantly salt—with a brush wet one side of the paper, and with a clean linen rag wipe off the superfluous moisture.

When this paper is dry, prepare a solution of nitrate of silver, consisting of one part of nitrate and twelve parts of distilled water, or rain water caught at a distance from any building. With this solution paint over the salted side of the paper; as soon as it is dry, give it another coat of the same solution, and when this last-applied coat is dry the paper is fit for use. The latter part of the process must be performed by candle-light or in a darkened room. The paper thus made must be carefully kept from the light, or else it will soon become discoloured.

To make use of this paper, have a wooden frame made, resembling the frame of a drawing board, of the size required—let a piece of glass be cut so as to fit into the rabbet of this frame. A backboard is to be made, covered with a kind of cushion. A piece of wadding covered with silk will answer the purpose.

The object to be copied—say it is a leaf—is to be laid upon the glass; the paper, with its prepared side touching the leaf, is then laid on it, the backboard applied, to press the paper close to the object, and secured in its place in the usual manner by means of small sticks or battens.

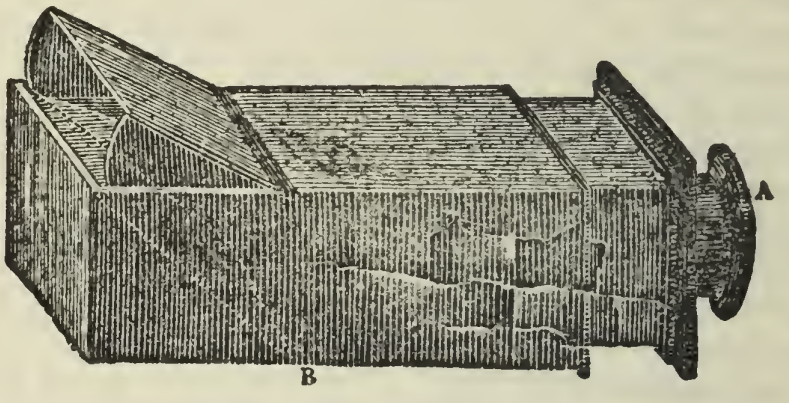
If the glazed side of the frame is now placed so that the sun may shine on it, the paper will become dark where the light can act upon it, and when sufficiently dark, the sun-drawing is to be taken out of the frame and placed between the leaves of a book.

TO FIX THE DRAWING.

There are several ways of fixing a photogenic drawing; the simplest is to immerse the drawing in a strong solution of salt and water; this answers very well if the drawing is kept in a portfolio, and only occasionally exposed to the light.

A second plan is by passing it through a weak solution of hypo-sulphite of potash, but this requires so much care we can scarcely recommend it, as, in case of failure, the drawing will be spoiled.

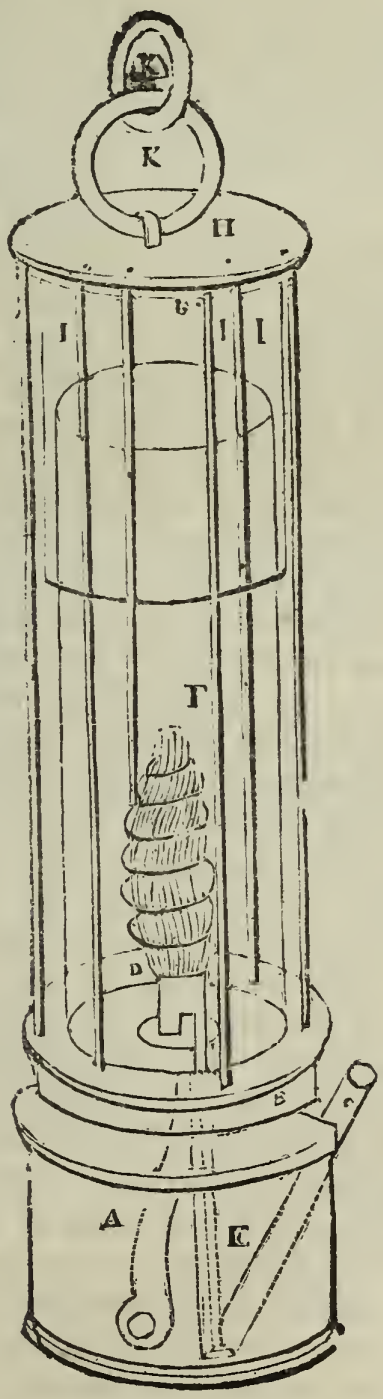
Perhaps the best method is to dip it into a weak solution of ammonia; this causes the drawing to become of a yellowish brown colour, but if done with care it is by far the best plan.



THE CAMERA OBSCURA.

The camera obscura, or dark chamber, when made as in the engraving, consists of two boxes, one sliding within the other; the smaller box has at A a double concave lens, whose focus is about equal to the length of the box itself. Inside the larger box, a piece of looking-glass is placed, extending from B in the direction of the dotted line to the upper edge of the dotted line; this glass forms an angle of 45 with the end of the box. On the top of the box, at this end, a piece of ground-glass is laid in a grove, extending along the top to a spot immediately above B. C shows a sliding lid, which prevents the light falling on the ground glass. Direct the lens at A towards any object you wish to copy, and move the box to which it is attached in or out, until a clear image of the object is seen on the ground glass. This may be drawn in with a pencil and afterwards copied. But a piece of glass, prepared as follows, is infinitely superior to the ground glass. Take some skimmed milk, taking care it is perfectly free from grease, and boil it until about half the water has evaporated; with this liquid wash over one side of a piece of clear glass. When dry, place it in the camera, in the place of the ground glass, with the varnished side uppermost. The image now will be seen to be extremely vivid, and if a drawing is made with a black-lead pencil, by laying a piece

of paper, slightly moistened, upon it, and rubbing the back of the paper with a burnisher or ivory knife, the drawing will be transferred to the paper, and can be finished at leisure.



THE DAVY SAFETY LAMP.

This lamp, which is the invention of Sir Humphrey Davy, was intended by him to guard against the numerous

accidents which occurred by the use of candles or lamps on the common construction, in the shafts of coal-mines when filled with inflammable air. It consists essentially of two cylinders of wire gauze, one within the other, the flame of the lamp being, of course, in the inner cylinder. Sir Humphrey Davy discovered that flame could not pass through a small aperture, unless the plate in which the aperture was made was extremely thin. Acting upon this knowledge, he procured wire gauze, of different degrees of thickness, and the openings of various diameters, and he soon discovered that, unless the openings were very large, or the wire extremely thin, although inflammable air would of course pass through, yet flame would not. [This fact may be easily proved by pressing a piece of wire gauze on to the flame of a gaslight: the flame will be depressed, and cannot pass through the openings, but that the gas passes is easily seen, for a lighted paper held above the gauze will immediately ignite it.] In the case of the lamp, as soon as the workman enters a place filled with inflammable air, the air will pass through the gauze, and become ignited by the flame of the lamp; the whole of the interior of the lamp will be instantly filled with flame, and the wire become red hot; but no flame can pass outside so as to ignite the inflammable air in the shaft.

When this lamp is lighted, if the air is pure, it burns, of course, in the usual manner; but as soon as the carburetted hydrogen forms as much as one-twelfth of the volume of the air, the gauze cylinder becomes filled with a feeble blue flame, but the flame of the wick is still seen burning brightly in the centre; the light of the wick continues to increase, until the inflammable gas is equal to one-sixth or one-fifth, when it is lost in the flame of the firedamp, which now fills the cylinder with a pretty strong light. As long as the air continues inflammable, the light in the lamp continues; but as soon as the foul air constitutes one-third of the atmosphere, the light is extinguished.

To prevent the mischief which might arise by thus leaving the miner in utter darkness, a coil of platinum wire is fixed above the wick, and this continues to glow for a considerable time, and gives sufficient light to enable the miner to escape.

THE MAGIC LANTERN.

The construction of this amusing optical machine is

so well known, that to describe it would be superfluous; particularly as it can now be purchased at a very reasonable expense, at any of the opticians': but as many persons who have a taste for drawing, might not be pleased with the designs to be had at the shops, or might wish to indulge their fancy in a variety of objects, which to purchase would become expensive, we here present our readers, in the first place, with the method of drawing them, which will be succeeded by a plain description of some very diverting experiments.

OF PAINTING THE GLASSES.

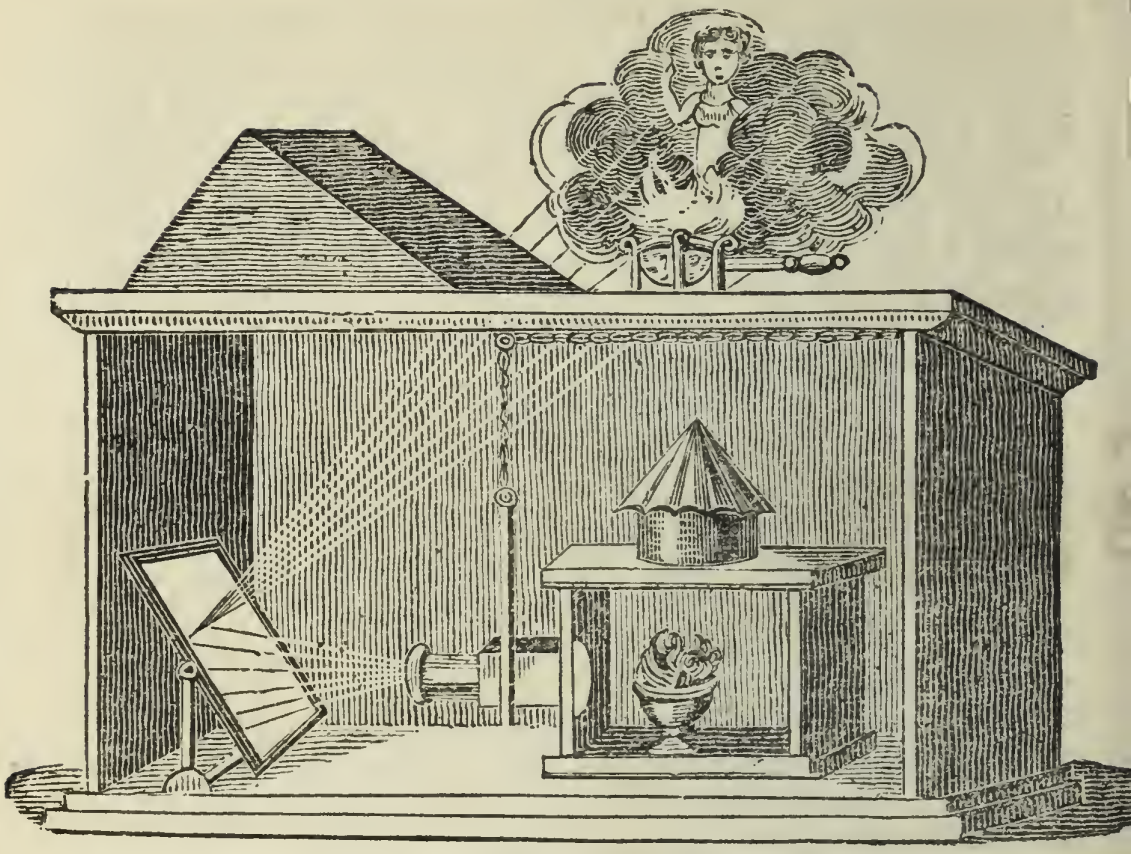
You first draw on a paper, the size of the glass, the subject you mean to paint: fasten this at each end of the glass with paste, or any other cement, to prevent it from sliping. Then, with some very black paint mixed with varnish, draw with a fine camel's hair pencil, very lightly, the outlines sketched on the paper, which, of course, are reflected through the glass. Some persons affirm that these outlines can be more readily traced with japan writting-ink, and a common pen with a fine nib; but this, even if it succeed in making a delicate black outline, is sure to be effaced by damp or wet.

It would improve the natural resemblance, if the outlines were drawn with a strong tint of each of the natural colours of the object: but in this respect you may please you own fancy. When the outlines are dry, colour and shade your figures; but take care to temper your colours with strong white varnish. A pleasing effect will be produced, if you leave strong lights in some parts of the drapery, &c., without any colours. The best colours for this purpose are transparent ones; opaque or mineral colours will not do. The following are in most repute:

For Pink and crimson..	Lake or carmine.
Blue	Prussian blue.
Green.....	Calcined verdigris, or distilled ditto.
Yellow	Gamboge.

TO PRODUCE THE APPEARANCE OF A SPECTRE ON A PEDESTAL IN THE MIDDLE OF THE TABLE.

Enclose a small magic lantern in a box (as in Engraving), large enough to contain a small swing dressing-glass, which will reflect the light thrown on it by the lantern in such a way, that it will pass out at the aperture made at



the top of the box, which aperture should be oval, and of a size adapted to the cone of light to pass through it. There should be a flap with hinges, to cover the opening, that the inside of the box may not be seen.

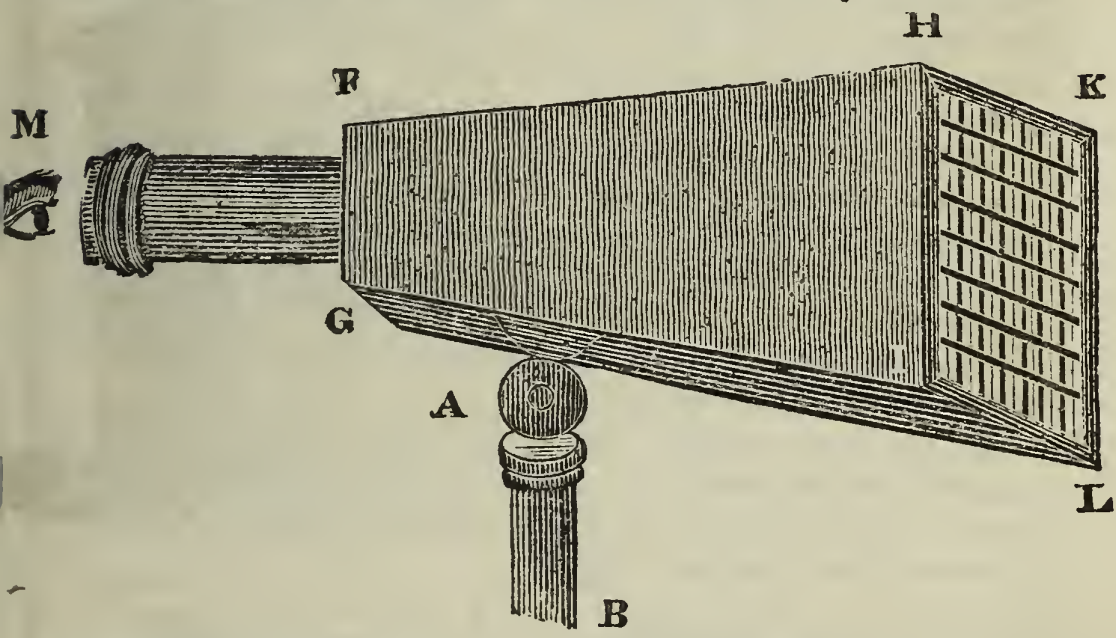
There must be holes in that part of the box which is over the lantern, to let the smoke out; and over this must be placed a chafing-dish of an oblong figure, large enough to hold several lighted coals. This chafing-dish, for the better carrying on the deception, may be inclosed in a painted tin box, about a foot high, with a hole at top, and should stand on four feet, to let the smoke from the lantern escape.

There must also be a glass planned to rise up and down in the groove, and so managed that it may be raised up and let down by a cord and pulley, coming through the outside of the box. On this glass, the spectre, (or any other figure you please,) must be painted in a contracted or squat form, as the figure will reflect a greater length than it is drawn.

When you have lighted the lamp in the lantern, and placed the mirror in a proper direction, put the box on a

tabl , and setting the chafing-dish in it, throw some incense in powder on the coals. You then open the trap door and let down the glass in the groove slowly, and when you perceive the smoke diminish, draw up the glass that the figure may disappear, and shut the trap-door.

This exhibition will afford a deal of wonder; but observe, that all the lights in the room must be extinguished; and the box should be placed on a high table, that the aperture through which the light comes out may not be seen.



TO DRAW, EASILY AND CORRECTLY, A LANDSCAPE, OR ANY OTHER OBJECT, WITHOUT BEING OBLIGED TO OBSERVE THE RULES OF PERSPECTIVE, AND WITHOUT THE AID OF THE CAMERA OBSCURA.

Procure a box of pasteboard, F G H I K L, of about a foot and a half long, and made in the shape of a truncated pyramid, whose base, H K I L, is eight inches wide, and six inches high. Fix to the other end of it a tube of four or five inches long, and which you can draw out from the box more or less. Line the inside of the box with black paper, and place it on a leg or stand of wood, B, and on which it may be elevated or depressed by the hinge, A.

Take a small frame of wood, and divide it at every inch by lines of black silk drawn across it, forming forty-eight equal parts; divide these into still smaller equal parts, by lines of finer silk;* fix this frame at the end H K L, as the base of the pyramid.

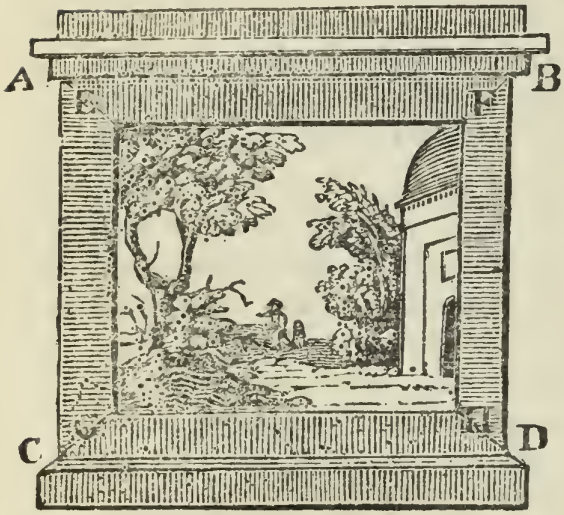
* The different thickness of the silk serve to distinguish more exactly the corresponding divisions.

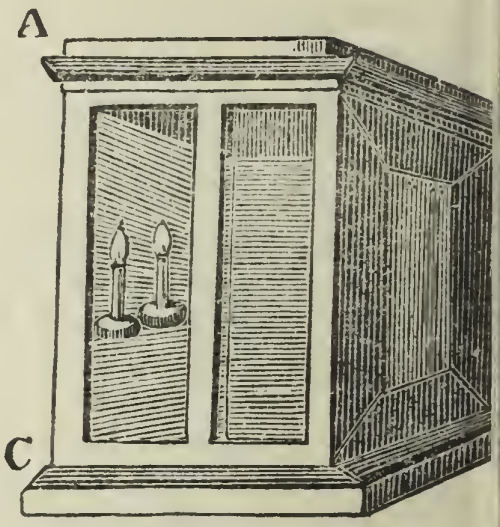
Provide a drawing paper, divided into the same number of parts as in the frame, by lines, lightly drawn in pencil. It is not material of what size these divisions are; that will depend entirely on the size you propose to draw the objects by this instrument.

Place this instrument opposite a landscape, or any other object that you want to draw, and fix the leg firmly on, or in the ground, that it may not shake: then turning it to the side you choose, raise or incline it, and put the tube further in or out, till you have gained an advantageous view of the object you intend to draw.

Place your eye, M, by the instrument, which you have adjusted to the height of your eye, and looking through the tube, carefully observe all that is contained in each division of the frame, and transpose it to the corresponding division in your paper: and if you have the least knowledge in painting, or even drawing, you will make a very pleasing picture, and one in which all objects will appear in the most exact proportion.

By the same method you may draw all sorts of objects, as architecture, views, &c. and even human figures, if they remain some time in the same attitude, and at a proper distance from the instrument.





ILLUMINATED PROSPECTS.

Provide yourself with some of those prints that are commonly used in optical machines, printed on very thin white paper; taking care to make choice of such as have the greatest effect from the manner in which the objects

are placed in perspective. Place one of these on the borders of a frame, and paint it carefully with the most lively colours, making use of none that are terrestrial. Observe to retouch those parts several times where the engraving is strongest,* then cut off the upper part or sky, and fix that on another frame.

The prints being thus prepared, place them in a box, A B C D, the opening to which, E F G H, should be a little less than the print. Cover this opening with a glass, and paint all the space between that and the prints, which should be about two or three inches, black. The frame that contains the sky should be about an inch behind the other. In the back part of this box, which is behind the prints, and which may be about four inches deep, place four or five small candlesticks to hold wax lights, and cover that part entirely with tin, that it may be the more luminous.

When the print is placed between the wax lights and the opening in the front of the box, and there is no other light in the room, the effect will be highly pleasing; especially if the lights are at a sufficient distance from each other, and not too strong, that they may not occasion any blots in the print. Those prints that represent the rising or the setting of the sun will have a very picturesque appearance. Such as represent conflagrations have also a striking effect.

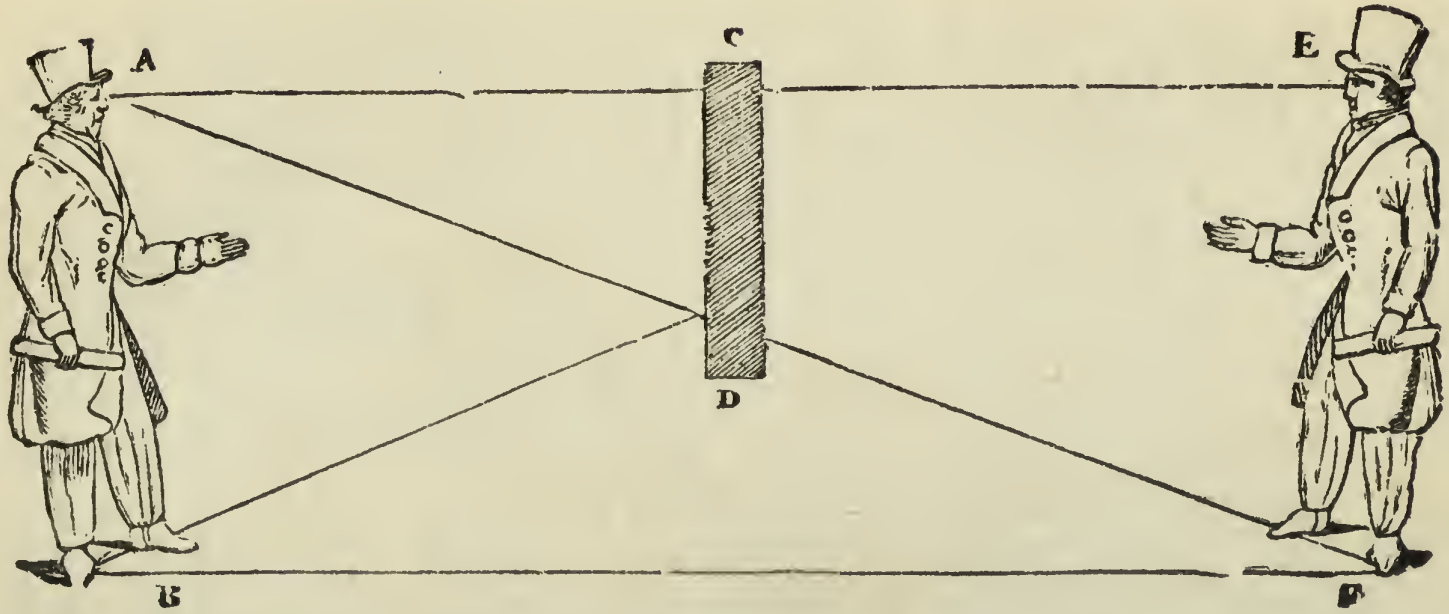
There should be two grooves for the print next the glass, that you may insert a second subject before you draw away the first: and that the lights in the back of the box may not be discovered.

You must not, thinking to make the print more transparent, cover it with varnish; for that will prevent the gradation of the colours from being visible. The frame should enter the side of the box by a groove, that a variety of subjects may be introduced.

TO MELT METAL ON A PIECE OF PAPER OVER A CANDLE.

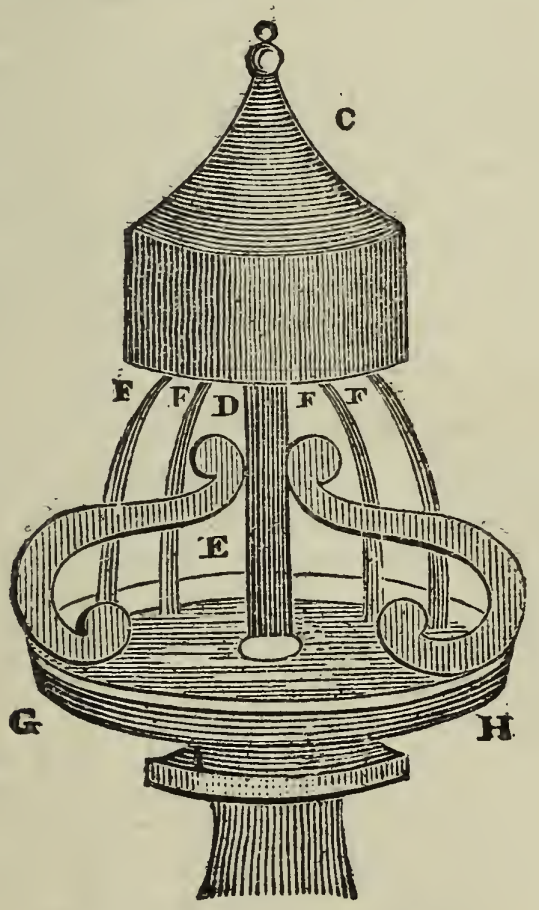
Melt together equal parts of bismuth, lead, and zinc; lay them on a piece of paper, and you may keep them in a state of fusion by holding them, on the paper, over a candle.

* When you colour a print, place it before you, against a piece of glass, in a position nearly erect, that it may be enlightened by the sun. You may also colour both sides of the print.



The image of any object placed before a plain mirror (looking-glass) appears to the eye to be at the same distance behind the mirror as the real object is in its front. In the engraving, A B represents a man standing in front of the mirror C D; his image, E F, according to the law of optics we have noticed, appears immediately opposite to him, and at the same distance behind the glass that he himself is standing in front of it. Another point illustrated by the diagram is this, that a looking-glass, say three feet in height, will reflect the image of an object six feet high. The ray of light from the foot of the man at B is reflected to the eye at A, and the mind refers the position of the reflected image of that foot to F, three feet below the glass. The reason the eye at A only sees the reflection

of the foot B at that point of the glass which is marked G is, because a ray of light falling on a flat polished surface is always reflected at the same angle by which it arrives at that surface, or, in other words, the angle of *incidence* is equal to the angle of *reflection*, and therefore the angle formed by the line B G with the glass is equal to that formed by G A. The reflected image is a perfect counterpart of the object with one exception, —namely, the right hand of the object becomes the left hand of the figure, and *vice versâ*.



THE MAGICAL CASCADE.

Procure a tin vessel, shaped like the figure, about five inches high, and four in diameter, with a cover, as C, closed at top. To the bottom of this vessel, let the pipe D E be soldered. This pipe is to be ten inches long, and half an inch in diameter, open at each end, and the upper end must be above the water in the vessel. To the bottom also fix five or six small tubes, F, about one-eighth of an inch in diameter. By these pipes, the water in the vessel is to run slowly out.

Place this machine in a tin bason, G H, with a hole in the middle, about a quarter of an inch in diameter. Fix to the tube, D E, any sort of ornament that will keep the machine firm on the bason, observing, that these supports are sufficiently long to leave about a quarter of an inch between the end of the tube and the orifice in the bason; and let there be a vessel under the bason to catch the water that runs out.

As the small pipes discharge more water into the bason than can run out of the central orifice, the water will rise in the bason above the lower end of the pipe, and prevent the air from getting into the vessel, by which the water will cease to flow from the small pipes. But as the water continues to flow from the bason, the air will have liberty again to enter the vessel by the tube, and the water will again flow from the small pipes, and alternately stop and flow, while any water remains in the vessel.

As you can guess when the pipes will flow, and when they will stop, you may so manage it, that they will appear to act by word of command.

THE ENCHANTED BOTTLE.

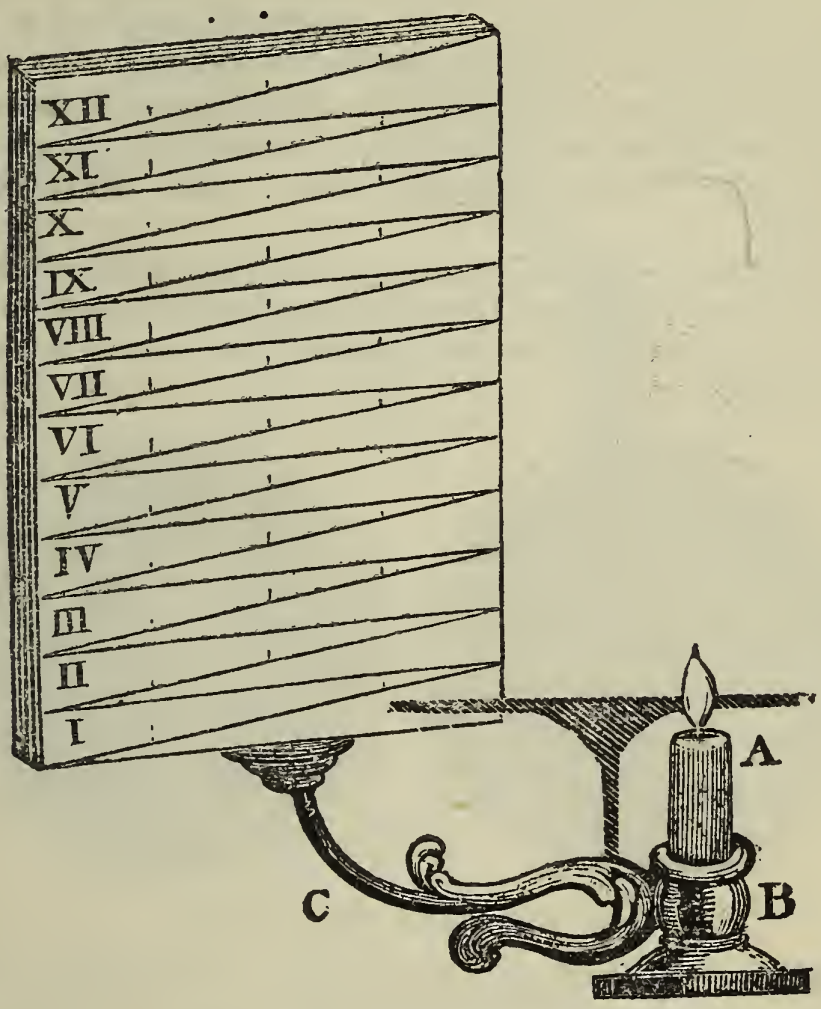
Fill a glass bottle with water to the beginning of the neck; leave the neck empty, and cork it. Suspend this bottle opposite a concave mirror, and beyond its focus, that it may appear reversed. Place yourself still further distant from the bottle; and instead of the water appearing, as it really is, at the bottom of the bottle, the bottom will empty and the water appear at the top.

If the bottle be suspended with the neck downwards, it will be reflected in its natural position, and the water at the bottom, although, in reality, it is inverted, and fills the neck, leaving the bottom vacant. While the bottle is in this position, uncork it, and let the water run gradually out; it will appear, that while the real bottle is emptying, the reflected one is filling. Care must be taken that the bottle is not more than half or three parts full, and that no other liquid is used but water, as in either of these cases the illusion ceases.

TO FORM FIGURES IN RELIEF ON AN EGG.

Design on the shell any figure or ornament you please, with melted tallow, or any other fat oily substance; then

immerse the egg into very strong vinegar, and let it remain till the acid has corroded that part of the shell which is not covered with the greasy matter: those parts will then appear in relief, exactly as you have drawn them.



THE LAMP CHRONOMETER

The above figure represents a chamber lamp, A, consisting of a cylindrical vessel made of tin, in the shape of a candle, and is to be filled with oil. This vessel should be about three inches high and one inch in diameter, placed in a stand, B. The whole apparatus, of lamp and stand, can be purchased ready made, at any tin-shop in London. To the stand B, is fixed the handle C, which supports the frame D, about 12 inches high, and four inches wide. This frame is to be covered with oiled paper, and divided into 12 equal parts by horizontal lines, at the end of which are written the numbers for the hours, from 1 to 12, and

between the horizontal lines and diagonals, divided into halves, quarters, &c. On the handle C, and close to the glass, is fixed the stile or hand, E.

Now, as the distance of the stile from the flame of the lamp is only half an inch, then, if the distance of the frame from the stile be six inches, while the float that contains the light descends by the decrease of the oil, one inch, the shadow of the stile on the frame will ascend 12 inches, being its whole length, and show by its progression the regular increase of the hours, with their several divisions.

You must be careful always to burn the same oil, which must be the best; and the wick must never vary in size. If these precautions are not attended to, the dial never can be accurate.

THE MULTIPLYING MIRROR.

This feat must be performed with a looking-glass made on purpose; the manner of making it is this:—First, make a hoop, or fillet of wood or horn, about the size of a half-crown piece in circumference, and about a quarter of an inch in thickness In the middle, fasten a bottom of wood or brass, and bore in it several small holes, about the size of peas; then open one side of this bottom, set in a piece of crystal-glass, and fasten it in the hoop close to the bottom. Take a quantity of quicksilver, and put as much into the hoop as will cover the bottom; then let into it another piece of cyrstal-glass, fitted to it; cement the sides, that the quicksilver may not run out, and the apparatus is complete. One side will reflect the beholder's face as a common looking-glass; in the other

it will be multiplied according to the number of holes in the wood or brass.

BOTTLE-IMPS

THE requisites for this experiment are a glass vase about fifteen inches high, and three little glass figures, hollow, with a small hole in each of their legs. These may be obtained at the glass-houses, and may be blown to represent harlequin, columbine, pantaloon, &c., or imps, or any other figure to the fancy of the exhibitor. The vase is to be nearly filled with water, the figures immerged so as not to allow the air within them to escape, and the top of the vase to be covered with a bladder, and tied tight. There must be a small space between the surface of the water and the bladder, which will of course be occupied

with air. If you then press your hand on the top, as shown in the engraving, the figures will sink, and as you lighten the pressure, they will rise. By these means you may give them the appearance of dancing about the glass at your pleasure.

AN UNPLEASANT METAMORPHOSIS.

Take a few nutgalls, and bruise them to as fine a powder as possible, which spread nicely over a towel. Into a bason of water put a little brown copperas, which will soon dissolve, leaving the water transparent as before. Should any one wash his face or hands in this water, and use the towel prepared as above, the parts subjected to the application will become perfectly black. It will be some days, however, before the application of soap and water will remove the stains; and this trick, therefore, is too mischievous for performance.

INCOMBUSTIBLE THREAD.

If you wind some linen thread tightly round a smooth pebble, and secure the ends, you may expose it to the flare of a candle without danger of burning it; the reason being, that the caloric traverses the thread without affecting it, attacking only the stone which it encases.

HOW TO CUT A POKER IN TWO.

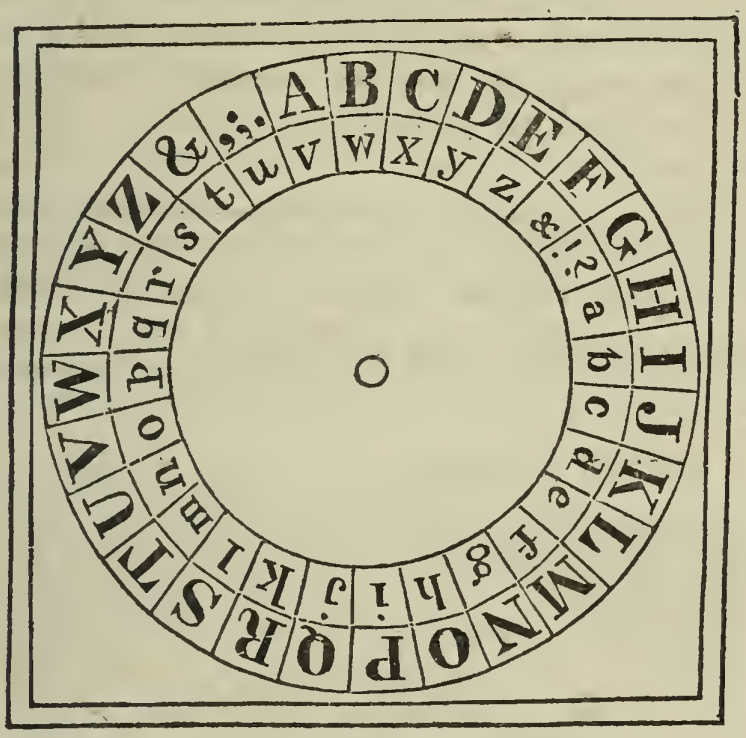
A rod of iron may be melted in a common fire, or divided into parts, in the following way. Make the iron hot to a white heat. Have ready a roll of brimstone; hold the brimstone, by a pair of tongs, to the end of the iron. A profusion of the most brilliant coruscations will be emitted, and the molten iron will drop like sealing-wax held to a candle. By the same rule, if the brimstone is applied to the side of the heated iron, it will cut it through.

THE MAGIC SPOON.

Put four ounces of bismuth into a crucible, and when in a state of complete fusion, throw in two ounces and a half of lead, and one ounce and a half of tin; these metals will combine, and form an alloy fusible in boiling water. Mould the alloy into bars, and take them to a silversmith to be made into tea-spoons. Place one of them in a saucer, at a tea-table, and the person who uses it

will not be a little astonished to find it melt away as soon as he puts it into the hot tea.

SECRET CORRESPONDENCE.



To carry on a correspondence, without the possibility of the meaning of the letter being detected, in case it should be opened by any other person, has employed the ingenuity of many. No method will be found more effectual for this purpose, or more easy, than the following:—

Provide a piece of square card or pasteboard, and draw a circle on it, which circle is to be divided into 27 equal parts, in each of which parts must be written *one* of the capital letters of the alphabet, and the &, as in the figure. Let the centre of this circle be blank. Then draw another circle, also divided into 27 equal parts, in each of which write one of the small letters of the alphabet, and the &. This circle must be cut round, and made exactly to fit the blank space in the centre of the larger circle, and must run round a pivot or pin. The person with whom you correspond must have a similar dial, and at the beginning of your letter you must put the capital letter, and at the end the small letter, which answer to each other when you have fixed your dial.

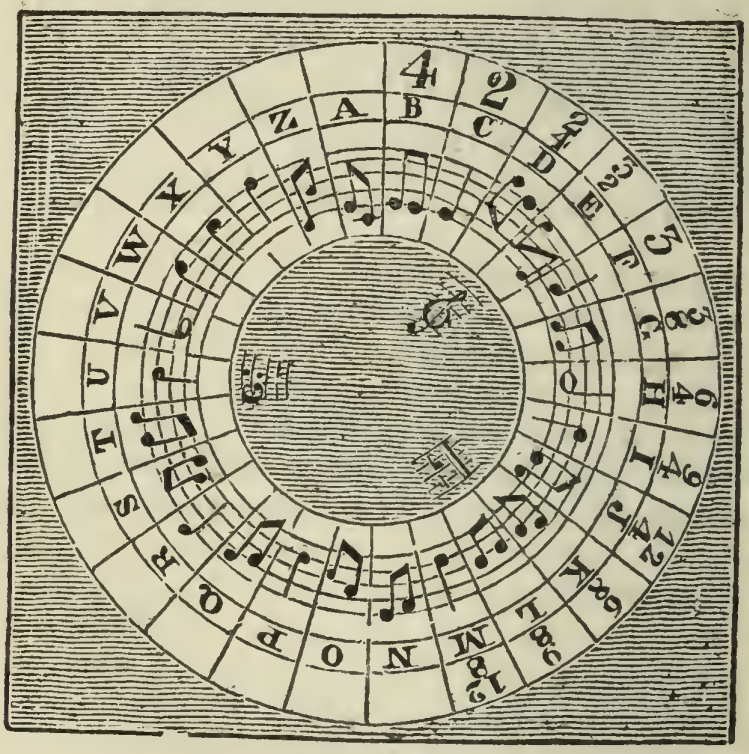
Suppose what you wish to communicate is as follows:—

I am so watched I cannot see you as I promised; but I will meet you tomorrow in the park, with the letters, &c.

You begin with the letter *T*, and end with the letter *m*, which shows how you have fixed the dial, and how your correspondent must fix his, that he may decipher your letter. Then, for *I am*, you write *b uf*, and so of the rest, as follows:—

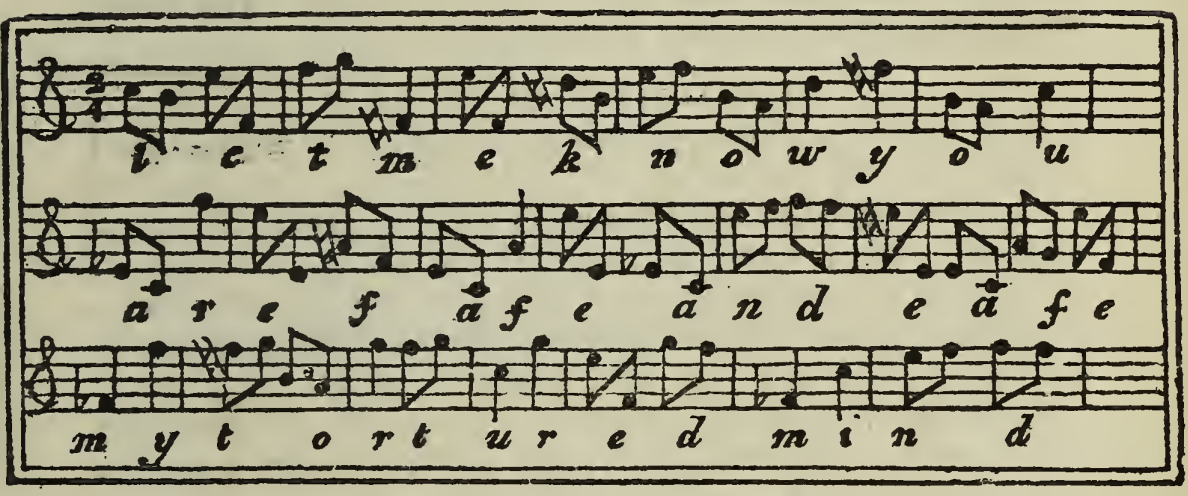
T b uf lh pumwayx b wugghm lyy rhn ul b ikhfblyx vnm b pbee fyym rhn mh fhkkhp bg may iukd pbma may eymmykl, tw. m.

SECRET CORRESPONDENCE BY MUSIC.



Form a circle like the first engraving, divided into twenty-six parts, with a letter of the alphabet written in each. The interior of the circle is moveable, like that in the second figures in Fig. 1, and the circumference is to be ruled like music-paper. Place in each division a note different in figure or position.

Within the musical lines place the three keys, and on he outer circle the figures to denote time. Then get a ruled paper, and place one of the keys (suppose *ge re sol*) against the time, 2-4ths, at the beginning of the paper, which will inform your correspondent how to place his circle. You then copy the notes that answer to the letters of the words you intend to write, in the manner expressed at the bottom of the figure.



TO RESTORE A FADED ROSE.

Spread some sulphur on a chafing-dish of hot coals, and hold over its fumes a rose that is quite faded; it will become perfectly white. Dip it into water, and put it into a box or drawer for three or four hours. When taken out it will have again become perfectly red.

A BEAUTIFUL DYE.

Dissolve a piece of indigo in diluted sulphuric acid, and add to it, in equal quantity, a solution of carbonate of potass. A piece of white cloth dipped into this dye will be changed to blue; yellow cloth will become green; red will be changed to purple; and blue paper be turned red.

TRANSMUTATION OF METALS.

Into a solution of nitrate or sulphate of copper dip a piece of polished iron—the blade of a table-knife, for instance, and it will assume the appearance of a piece of pure copper: which is caused by the sulphuric acid adhering to the iron and the precipitation of the copper.

FRENCH PHOSPHORIC MATCHES.

The recipe is as follows:—Put a quantity of mucilage of gum arabic into an earthenware vessel, and heat it to the temperature of 100° or 125° Fahrenheit: to four parts of this mucilage add one part of phosphorus: it will instantly melt, and should be well stirred and well mixed with the mucilage: add chlorate of potash in powder, nitrate of potash, and a little benzoin, to form a soft paste; into which dip the ends of the match-sticks. The mass constitutes what is called *fulminating tinder.*

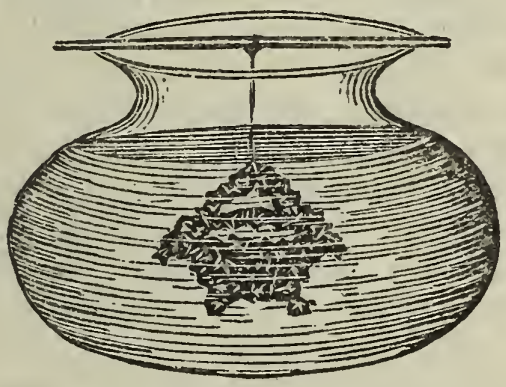
CRYSTALLIZATION OF ALUM.

The principle of this pleasing operation has been chiefly confined to the fabrication of flower-baskets for chimney ornaments, and the enchasements with an artificial crystal of busts, &c.; but the more extensive applications of aluminous crystallization may be introduced, as promising a somewhat higher order of gratification, more particularly to the lovers of botany and other branches of natural history.

Dissolve 18 ounces of pure alum in a quart of soft spring water (observing the same proportion for a greater or less quantity), by boiling it gently in a close tinned vessel, over a moderate fire, keeping it stirred with a wooden spatula until the solution is complete. When the liquor is *almost* cold, suspend the subject to be crystallized by means of a small thread or twine, from a lath or small stick laid horizontally across the aperture of a deep glass or earthern jar, as being best adapted for the purpose, into which the solution must be poured. The respective articles should remain in the solution 24 hours; when they are taken out they are to be carefully suspended in the shade until perfectly dry. The whole process of crystallization is best conducted in a cool situation. When the subjects to be crystallized are put into the solution while it is quite cold, the crystals are apt to be formed too large, on the other hand, should it be too hot, the crystals will be small in proportion. The best temperature is about 95° of Fahrenheit's thermometer.

Among vegetable specimens that may be operated on are the moss-rose of the gardens; ears of corn, especially millet-seed, and the bearded wheat; berries of the holly; fruit of the slow-bush; the hyacinth; pink; furze-blossoms; ranunculus; garden daisy; and a great variety of

others: in fact, there are few subjects in the vegetable world that are not eligible to this mode of preservation. The fitness of the solution for the purpose may be ascertained by putting a drop of it on a slip of glass, and seeing if it crystallizes as it cools: if so, the solution is sufficiently strong. Then twist round a sprig of plant, a cinder, or a wire ornament of any kind, some cotton, or still better some worsted. After being immersed as already directed, the surface of the whole will be found covered with beautiful crystallizations.



If a solution of common alum be set aside, the liquid will gradually evaporate, and leave minute crystals at the bottom of the vessel. These by degrees increase in numbers, and grow larger.

CRYSTALLIZATION OF SALTS, ETC.

To Crystallize numerous Salts together.—Dissolve in seven different tumblers, containing water, half an ounce each of sulphate of iron, copper, zinc, soda, alum, magnesia, and potass. Pour them all, when completely dissolved, into a large evaporating-dish, and blend the whole with a glass rod. Place the dish in a cool place, where it cannot be affected by dust, and where it is not liable to be agitated. When evaporation has taken place, the whole will begin to shoot out into crystals. These will be presented in small groups, with single crystals scattered amongst each other, giving a very curious appearance to the general mass. The sulphate of copper will communicate its own blue tinge to the alum, &c.

To obtain large Artificial Crystals.—This experiment requires considerable address and much patient attention, but the result fully compensates the trouble. The salt to be crystallized is to be dissolved in water, and evaporated

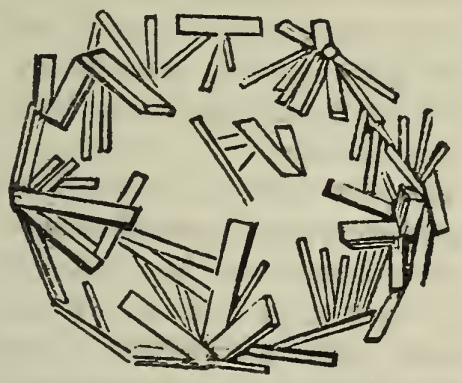
to such a consistency that it will crystallize on cooling Set it by, and, when quite cold, pour the liquid off the mass of crystals at the bottom, and put it into a flat-bottomed vessel. Solitary crystals form at some distance from each other, and these may be observed gradually increasing. Pick out the most regular of these, put them into a flat-bottomed vessel, at some distance from each other, and pour over them a quantity of liquid obtained in the same way, by evaporating a solution of the salt, till it crystallizes on cooling. Alter the position of every crystal, once at least every day, with a glass rod, that all the faces may be alternately exposed to the action of the liquid; for the face on which the crystal rests never receives any increase. By this process the crystals gradually increase in size. When they have acquired such a magnitude that their forms can easily be distinguished, the most regular are to be chosen, or those which have the exact shape which we wish to obtain; and each of them is to be put separately into a vessel filled with a portion of the same liquid, and turned in the same manner several times a day. By this treatment they may be obtained of almost any desired size. Whenever it is observed that the angles and edges of the crystals become blunted, the liquid must immediately be poured off, and a portion of new liquid put in its place; otherwise the crystal is infallibly destroyed.

To crystallize Glass Windows, and thus render them semi-opaque.—Make a hot saturated solution of Epsom salts, or, still better, of sal-ammoniac. Wet the glass window with this solution, laid on equally with a paint-brush. The moisture will almost instantly be evaporated, and the salt be deposited in a very beautiful radiated form. This deposition will admit the light, yet cannot be seen through; and, for rendering windows semi-opaque, is infinitely to be preferred to paint, paste, or any of the other materials commonly employed for this purpose.

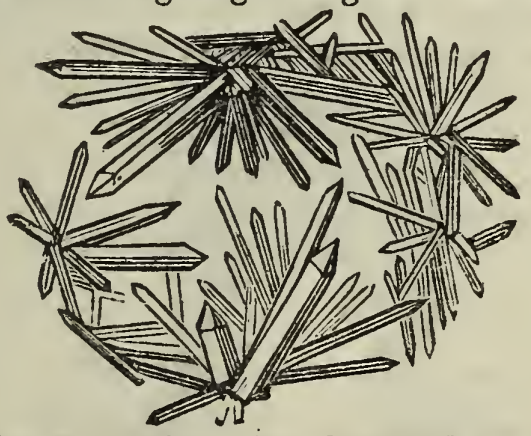
Upon the same principle, if the surface of a slip of glass be washed over with a hot solution of the required salt, it will present an exceedingly beautiful figure of crystallization, when examined by a pocket lens or microscope. Sal-ammoniac will give a similar result.

The different forms that the crystals take, and the certainty with which every salt assumes a figure peculiar to

itself, is very curious. The solution of common salt, if scattered on glass in single drops, leaves, on evaporation, a crystal of a perfect cubcial, or square shape. Epsom salts yield a very beautiful crystal, representing four-sided prisms, with flat ends, thus—



If, on the contrary, nitre, or glauber's salts, be used, the result will be six-sided prisms, with pointed ends, as shown in the following engraving:—

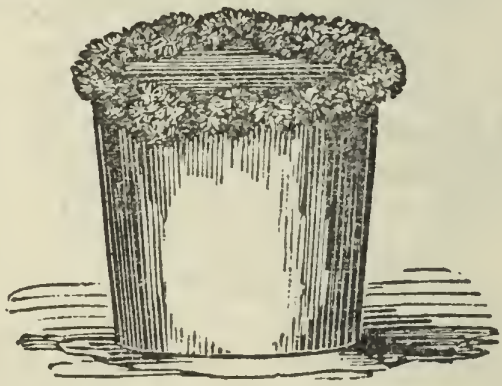


If either of these solutions be dropped on hot glass, the experimentalist will be enabled to watch the process of crystallization. Boracic acid, nitro muriate of gold, corrosive sublimate, acetate of morphia and of copper, rochelle salt, prussiate of potass, sulphate of quinine, deutioduret of mercury, chloride of copper, nitrate of silver, chromate of potass, nitrate of nickel, phosphates of lead and copper, sulphate of cobalt, and chlorate of potass, may all be made subjects of this interesting process. Sugar-candy is the product of the

Crystallization of Sugar.—Make a strong solution of loaf sugar; pour the syrup thus made into a vessel of any kind, which place in a slow oven; the evaporation being rapid, the sugar will be deposited in very small

crystals; or, in fact, the whole will become loaf-sugar again. Place some of the same solution in a pan, stretch one or more strings across the vessel, and set it aside, so that the evaporation may be very slow: instead of the sugar presenting a fine granular surface as before, it will appear in large well-formed crystals clinging to the strings. This is sugar-candy. Barley-sugar is not a crystallized but a fused mass, obtained by melting sugar by heat, without water, and then forming it by hand into the forms in which we are accustomed to see it.

We close this subject with a description and engraving of a very pretty *Arborescent Crystallization.*—Solutions of numerous salts, if left exposed to slow evaporation for a length of time, will not only deposit crystallization at the bottom of the liquid, but a curious formation of a fine, irregular mass of efflorescing crystals will spread over the sides of the vessel containing the solution, especially if it be earthenware. This is the case with sulphate of iron, sulphate of copper, and still better the acetate of lime, with which the experiment may be tried.*



THE LEAD TREE.

Put half an ounce of sugar of lead, in powder, into a clean glass globe, wine decanter, or large phial, filled with water. Add ten drops of nitric acid, or a little vinegar, and shake the mixture well; then take a small piece of zinc, about the size of a hazel-nut, tie it to a string which passes through a cork, that fits the phial; twist once or twice round the zinc a piece of fine brass or copper wire, and let the end of the wire depend from it in any agreeable form. Place the zinc and wire, thus prepared, so that it shall hang as near as possible in the axis of the

* For most of these interesting experiments in Crystallization we are indebted to FRANCIS'S CHYMICAL EXPERIMENTS.

bottle, and that no part shall touch either the top, bottom, or sides of it. Let the whole rest quietly for a short time. Metallic lead will soon deposit itself on the zinc, and along the wire, forming a brilliant illustration of chymical affinity. The zinc having a greater affinity for the acetic acid, which forms part of the sugar of lead, than the lead with which it is combined has, unites with it, and suffers the lead to be deposited. The liquid will change to the acetate of zinc. The use of the nitric acid is to dissolve a white cloudy precipitate, often formed when sugar of lead is dissolved in common water, or if it contain of itself any impurity. Filtering will also remove the cloudiness.

In the animal kingdom, the lizard, large spider, grasshopper, all the beetle kind, the nests of small birds, with their eggs, form beautiful specimens when neatly secured on portions of branches of the tree, &c., on which they are accustomed to roost. A considerable degree of attention is requisite to prevent too great a deposit of the alum on some of the above-mentioned subjects, by which their beauty would be obscured: they ought therefore to be frequently inspected while crystallization is going on, and removed as soon as it can be ascertained that they have acquired a sufficient coating. Various articles of turnery, &c., intended as chimney ornaments, in almost every diversity of form, if first carefully covered over with common cotton wound round them, may be submitted to crystallization with the same beautiful result.

The crystallized subjects may be tinged with almost any variety of colour, by boiling in the alum a solution of a little indigo, Brazil wood, logwood, French berries, or other vegetable or mineral dyes. A little care and ingenuity will enable the operator to confine his tints to the crystal surrounding the flower-blossoms, and other particular parts of plants which he may wish to preserve.

THE TIN TREE.

Into a vessel similar to that used in the last experiment pour distilled water as before; add 3 drams of muriate of tin, and 10 drops of nitric acid, and shake the vessel until the salt is completely dissolved. Suspend a piece of zinc as before, and the metal will in like manner be precipitated,—appearing similar to the lead tree, but having more lustre. This and the preceding experiment, and all others similar to them, are in reality galvanic, and show the powers of electricity in producing chymical action.

THE SILVER TREE, OR ARBOR DIANÆ.

Pour into a glass tube or decanter a quarter of an ounce of nitrate of silver, dissolved in a pint or more of distilled water, and lay the vessel on the chimney-piece, or in some place where it is not likely to be disturbed. Now pour in a quarter of an ounce of mercury; in a short time the silver will be precipitated in the most beautiful arborescent form, resembling real vegetation.

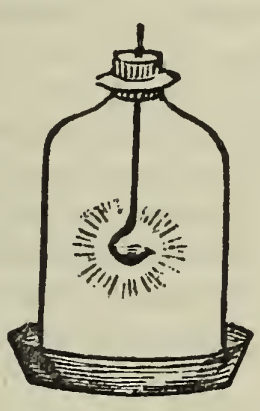
Another method.—Pour into a diluted solution of the nitrate of silver, as above, 1 drachm of nitrate of mercury, dissolved in 2 drams of water.

Another method.—Dissolve 6 drams of nitrate of silver, and 4 drams of nitrate of mercury in a decanter of distilled water; and then drop into it 6 drams of an amalgam of silver, composed of 3 drams of mercury and 1 of silver. This plan, says the writer of *Francis's Chymical Experiments*, to whom we are indebted for all the above receipts for Galvanic Trees, is considered the best, but it is rather too expensive.

OXYGEN.

Oxygen is a colourless gas that has neither taste nor smell. It is one of the constituent principles of air and of water, is absolutely necessary to animal existence, and is the most perfect of all supporters of combustion. Referring our readers to more regularly chymical works for instructions for its generation, it is sufficient for us to remark, that it is this last property which renders it the medium of so many pleasing experiments. If a lighted taper be immersed in oxygen, it will immedi-tely burn with great

intensity and rapidity. If the taper be blown out, so as to leave the wick, or snuff, as it is called, still burning, immersion in oxygen will immediately re-kindle the flame, and set it burning with great vividness. It is a knowledge of this property of oxygen that led to the invention of the *Bude Light*, now so universally known and admired; for the whole principle of the invention consists in passing a stream of oxygen through a burning lamp. The ordinary and most interesting mode of exhibiting this property of oxygen is by the



Combustion of Phosphorus.—Get a jar with a wide mouth, and if with an open bottom so much the better. Fill it with oxygen, and place it in a dish or pan with about an inch of water or sand at the bottom of it. If the glass vessel has a bottom, let it be covered with a like depth of water. Have a cork that will fill the mouth of the bottle tightly, with the stem of a deflagrating spoon (as seen in our engraving) fixed into it. In the bowl of the spoon place a small piece of lighted phosphorus, and introduce it into the jar, fastening down the cork. It will instantly burst into a flame that will light the whole room, and burn with an intensity that the eye can scarcely endure. The dense white fume that will instantly fill the jar is phosphoric acid.

Combustion of Sulphur.—Sulphur immersed in the same way in oxygen produces an intensely blue flame; and the vapour, which, after rushing to the top of the vessel, descends in a remarkably curious succession of rings, constitutes sulphuric acid.

Charcoal, exposed to the same species of combustion, burns with intense whiteness, and throws off a volume of brilliant sparks. The product is carbonic acid gas.

Effect of Oxygen on Glowworms.—If a glowworm be

immersed in a jar of oxygen, in a dark room, it will appear more lively, and shine with much greater brilliancy than in the common atmospheric air.

The Laughing Gas.—Oxygen is the gas popularly known under this designation. If a person inhale two or three quarts of it, he will feel much elated, and experience a great increase of muscular power, as long as the gas remains in the system.

The Specific Gravity of Oxygen is greater than that of common air. This may be demonstrated by filling a bottle with the gas, placing its mouth upwards, and withdrawing the cork. The gas will remain at the lower part of the vessel, as may be demonstrated by introducing a lighted taper, as directed in the preceding experiments. You may also hold the taper in one hand, and pour the gas on to it from the bottle in the other, as might be done with so much water: thus demonstrating that the gas is heavier than the atmospheric air.

HYDROGEN.

This gas, one of the constituents of water, is colourless, and, when pure, is free from smell. It is thirteen times lighter than atmospheric air, being the lightest body known in the realms of science, and is, therefore the best material for inflating balloons. Coal Gas is composed of hydrogen and carbon. It is not so light as pure hydrogen, but is sufficiently so for the purpose of balloon ascents; and all the ascents of the celebrated aeronaut, Mr. Charles Green, are made with coal gas. Hydrogen will not, while alone, support combustion; but, in conjunction with oxygen, it is inflammable and explosive in an extraordinary degree. These properties of hydrogen make it the medium of many interesting experiments. It may be generated by the following simple process: Put into a wine bottle a few iron nails, or filings if procurable, for they better suit the purpose; add some water, and then sulphuric acid equal in quantity to one fourth of the water. The iron will in a minute or two be covered with bubbles of gas, which will rise to the top of the vessel. These may be collected into a bladder fastened to the mouth of the bottle. In this process the water is decomposed, the oxygen unites with the metal as it is acted upon by the acid, and the other constituent, hydrogen, being lighter, escapes up-

wards. As great ebullition ensues, the vessel should not be more than half filled. An ounce of iron will yield 782 cubic inches of gas. Zinc is a very good substitute for the iron. Although it does not yield quite as much, the quantity being estimated at 676 inches of gas to each ounce of zinc, the gas is thrown off more rapidly than from iron. If is easy to ascertain how soon the gas begins to pass off by holding a candle to the mouth of the vessel. As soon as Hydrogen is present, it will ignite. Hydrogen may also be obtained from the decomposition of water; but as our young friends are not likely to have the requisite apparatus, we do not think it worth while to describe the process, although the gas thus procured is purer than that from iron or zinc. For the following experiments and processes, with which we close our treatise on hydrogen, we are indebted to 'Francis's Chymical Experiments.'

Hydrogen destructive to Animal Life.—Drop a small animal into a jar of hydrogen, and it will be instantly deprived of life. This appears to arise not from any deleterious property of the gas, but merely from the non-existence of oxygen, as mixtures of hydrogen and oxygen are respirable.

Inflammability of Hydrogen.—Drop into a common wine-bottle an ounce of iron nails, and pour upon it sulphuric acid, with four parts water. Through the centre of a cork which fits the bottle insert a tobacco-pipe stem; the gas which issues from the ingredients within the bottle will ascend through the pipe, and escape. If a light be applied to the gas as it passes out, it will catch fire, and burn with a dull yellowish flame, continuing ignited as long as the ingredients afford it in sufficient quantity. It is advisable to let the first portions of the gas escape, that they may carry off some of the air in the bottle. This has been called the *Philosophical Candle.*

Hydrogen Soap-bubbles.—Blow some soap-bubbles, filling them from a bladder of hydrogen, furnished with a brass pipe; they will ascend rapidly to the ceiling; if they are intercepted in their course by a lighted candle, they will explode with a dull report and a flash of yellow light.

Oxygen necessary for its Inflammation.—Let a shred of potassium fall into a bottle containing *only* hydrogen and a little water, and the gas will not take fire. This may easily be tried in the bottle in which hydrogen is being formed; but if a portion of common air be present, explosion ensues; therefore, great caution is necessary in performing the experiment.

Gilding Silk, Ivory, &c., by Hydrogen.—Immerse a piece of white satin, silk, or ivory, in a strong solution of nitro-muriate of gold. While this substance is still wet, immerse it in a jar of hydrogen gas: it will after some time be covered by a complete coat of gold. The hydrogen in this experiment decomposes the oxyde of gold, which is the base of the salt, appropriating to itself the oxygen, and suffering the gold to be deposited in a metallic state.

Producing Gilt Flowers, &c., on Silk or Ivory.—The foregoing experiment may be varied as follows: paint flowers, &c., on the silk, with the nitro-muriate of gold, and the aid of a very fine camel-hair pencil. Hold the silk thus painted over the bottle in which hydrogen is being liberated; in a short time the flowers will shine with considerable brilliancy, and will not tarnish upon exposure to air. The thickness of the coating of gold is not more than the 10-millionth part of an inch.

Silvering by Hydrogen.—Immerse a white silk ribbon in solution of nitrate of silver, and while wet expose it to a stream of hydrogen. The silver will be reduced to a metallic state on the silk. This may be varied, as in the preceding experiment. The same effect takes place with platinum, but not with any of the other metals, because all the others hold the oxygen contained in their oxydes too tenaciously for hydrogen to decompose them.

GLASS CUTTING AND ETCHING.

Fluoric Acid, which is obtained by mixing in equal quantities pounded Derbyshire spa and sulphuric acid, and placing them over the heat of a small furnace or strong lamp, has the peculiar property of cutting glass, being the only chymical agent that has that valuable power. All the so-called ground glass covers for lamps are roughed by immersion in fluoric acid, and not by manual labour, as the uninitiated suppose. Upon the same principle are etchings on glass made, in the mode following:—Procure several

clear pieces of crown glass, and immerse them in melted wax, so that each may receive a complete coating. When perfectly cold, draw on them, with a fine steel point, flowers, trees, houses, portraits, letters, &c. Whatever parts of the drawing are intended to be corroded by the acid should be perfectly free from the least particle of wax. When the drawings are finished, the pieces of glass must be immersed one by one in a square leaden receiver or box, (the experimentalist must bear in mind that the intense corrosive properties of this gas renders it impossible to keep it in earthen or glass vessels) either in a liquid or gaseous state. The gaseous, however, requires a much more complicated apparatus than the liquid acid. When the glasses are sufficiently impressed, or corroded, they are to be taken out, the operator wearing gloves to protect his hands from the extreme cutting properties of the fluoric, and the wax is to be removed, by dipping the glasses first in warm and then in hot water. The devices, if produced by the gas, will be opaque, like ground glass; if by the liquid, the figures will be equally transparent with the other parts of the glass. A simpler mode of etching on glass is, after preparing the etching on the wax, as already directed, to put the requisite ingredients into an evaporating-basin, to lay over it the sheet of glass, and to apply heat underneath till the ascending fumes have cut the glass as deep as desired; or after the drawing is duly etched on the glass, an edging of wax may be put all round it, and the fluoric acid poured on to it, and allowed to stand till the desired object is accomplished. This is the mode usual with engravers for etching on copper or steel. Be careful not imbibe any of the fumes of the acid, as they are exceedingly prejudicial.

CONVERSION OF CHALK INTO MARBLE.

Marble is supposed to be the result of heat and pressure combined, acting on chalk or limestone, in localities that would not admit of the escape of the carbonic-acid gas generated by the volcanic action, as is demonstrated by the following recipe for producing artificial marble:—Procure a strong cast-iron phial, with a screw stopper that will keep it air-tight. Fill it with chalk, and after securing the end with the screw, throw it into a strong fire for an hour or more. On removing it, allow it to cool gradually,

and, on opening it, you will find a carbonate so closely resembling white marble as to justify the hypothesis above mooted.

EFFECT OF WATER ON BURNING HOUSES.

Water thrown upon a house when on fire, if not in overpowering quantity, adds to the mischief, as the great heat decomposes it—its oxygen and hydrogen both aiding the combustion.

TO COVER A SHRUB WITH HOAR FROST.

Place a sprig of rosemary or any other garden herb in a glass jar, so that when it is inverted the stem may be downwards, and the sprig supported by the sides of the jar; put some benzoic acid on a piece of hot iron, so hot that the acid may be sublimed in the form of a thick white vapour. Invert the jar over the iron, and leave the whole untouched until the sprig becomes covered by the sublimed acid, appearing like hoar frost.

LUCIFER OR CONGREVE MATCHES.

Are a preparation of phosphorus, and are best made in the following manner:—The strips of wood are first dipped in melted sulphur; the points of them are then touched with a composition made in the following manner.—Place phosphorus, cut into small pieces, in a vessel, which should be closed accurately by a cover or stopper. Make an iron wire red hot, and stir up the phosphorus with it, by which it will be inflamed, and in some degree changed into an oxyde. The object of partially oxydating it, is to render it more inflammable. Withdraw the wire, and close the vessel, in order

to stop the inflammation. Then dissolve in water four times as much gum arabic as there is phosphorus. Add the phosphorus previously prepared to the thick gum-water, and heat it over a lamp, until the phosphorus is dissolved, or rather incorporated with the mucilage. Add a little colouring matter, and dip the sulphured ends of the matches in the mixture. When dry, they will become inflamed with a very little friction. Some manufacturers omit the slight oxydization of the phosphorus previous to its union with the gum-water. Also, it is common to stir into the mixture, along with the colouring matter, a small quantity of the chlorate of potass. This promotes the combustion, and occasions the slight noise made at the ignition of the match.—*Francis's Chymical Experiments.*

FUMIGATING-PASTILES, INCENSE, &c.

Incense is made by putting a little powdered gum-benzoin into an earthen or metal pot, and dropping on this powder a coin or some other piece of metal that has been previously heated. This heat will make the gum yield a dense white fume, of itself very agreeable in odour; which may be much improved by the addition of a little powdered frankincense, camphor, or Cascarilla bark. For the pastiles commonly used for scenting apartments, make a paste of the above ingredients by mixing them up with gum-water; mould them into the usual shapes, and, after they are dried, they will be ready for use.

INCOMBUSTIBLE CLOTHING.

If articles of attire be steeped in a solution made by dissolving borax in hot water, although they may be consumed by a slow combustion, like touch-paper, they will not ignite to a blaze. Alum has the same property, and so has the carbonate of potass; but the former injures the fabric of the articles saturated with it, and the latter attracts the atmospheric moisture.

TO PRESERVE OBJECTS OF NATURAL HISTORY.

Make a solution of corrosive sublimate, so weak that, when a black feather is dipped into it and afterwards dried, it will not exhibit any whiteness, and wash with it any small object of natural history, such as plants, insects, flowers, small animals, &c.; and it will protect them from insects, the growth of mould, &c.

PHOSPHORIC WRITING.

Insert a small piece of phosphorus in the end of a quill or reed, write on a wall or fence, and the writing will become luminous and legible after dark. The friction must be as slight as possible, as it is likely to ignite the phosphorus; and a basin of water should be at hand to extinguish it, in case of that casualty.

ARTIFICIAL RAINBOW.

Turn your back to the sun, and at a moderate distance, with a syringe, scatter the water into the air as high as possible, in a direction somewhat oblique to the horizon.

SYMPATHETIC INKS.

Make a very dilute solution of nitro-muriate of cobalt. When heated, the writing performed assumes a fine blue, if pure, or green, if impure. It disappears again when cooled.

An acetic solution of oxide of cobalt, with the addition of a little nitre. On exposing writing performed with this ink, it will assume a fine rose colour, which will disappear on cooling.

Sal-ammoniac and sulphate of copper, in equal parts, with water sufficient to render it liquid. This gives a yellow colour when heated, which, like the preceding, disappears on cooling.

The juice of an onion has a similar effect, and so has milk.

TO ILLUMINATE THE SURFACE OF WATER.

Wet a lump of fine loaf-sugar with phosphorized ether, and throw it into a basin of water. The surface of the water will become luminous in the dark; and, by gently blowing it, phosphorescent undulations will be formed, which will illuminate the air above the fluid, to a considerable distance. In winter, the water must be rendered blood-warm. If the phosphorized ether be applied to the hands (which may be done with safety), it will render them luminous in the dark.

TO RESTORE OBLITERATED WRITING.

To half a pint of pale sherry put six or eight of the whitest dyeing-galls, bruised; let them stand in the sun about five days, and then put them on the defaced writing, and it will almost immediately revive it.

USEFUL VARNISH.

The mixture used by fishermen to make stout calico jackets and other articles waterproof, is as follows:—1 gallon of plain linseed oil, 3s. 9d.; 3 oz. of sugar of lead, 9d.; 10½ oz. of white resin, 1½ d.; and ½lb. of mutton suet, 3d.; being, in all, 4s. 4½d. for a gallon. First put the oil into a proper vessel, then the lead, and let them simmer together for a short time; then put in the resin, and, last of all, the suet. When the whole have simmered together for some time, they will make a useful varnish, for many purposes, at a reasonable cost. The use of the sugar of lead is merely to dry the oil.

ANTI-MAGNETIC PROPERTY OF THE ONION.

The magnetic power of a compass-needle will be entirely destroyed, or changed, by being touched with the juice of an onion.

ÆOLIAN SEA-SIGNALS.

Among the projects of the day is an exceedingly ingenious one, and apparently by no means impracticable, for making the waves of the sea give a musical warning of the presence of breakers. The inventor proposes to have hollow buoys moored near the dangerous coast or sand-bank, to which buoys are to be affixed pipes, some what like those of the organ. Metal tongues, on the principle of the accordion, are to be fitted to the pipes, so that when the buoys are tossed up and down by the breakers, the air may be forced through, and cause them to utter warning sounds, which would become louder and louder as the sea raged more fiercely, and the danger increased.

TO GIVE PLASTER FIGURES THE APPEARANCE OF MARBLE.

Put into four pounds of clear water one ounce of pure curd soap, grated and dissolved in an earthen vessel well glazed. Then add one ounce of bees' wax, cut into thin slices. As soon as the whole is incorporated, it is fit for use. Having well dried the figure before the fire, suspend it by a twine, and dip it once into the varnish; upon taking it out, the varnish will appear to have been absorbed; in two minutes' time, stir the compost, and dip it a second time, and this generally suffices. Cover it carefully from the dust for a week; then with a soft mus-

lin rag, or some cotton wool, rub the figure gently, when a most brilliant gloss will be produced.

INDELIBLE LABELS FOR FLOWER-GARDENS.

Use pieces of zinc, and slightly rub with pumice-stone the portion upon which it is intended to write the label. Write on it with a common lead pencil, and, after two or three days' exposure to the air, the writing will be indelible, as far as the effects of weather are concerned. When the labels become covered with dirt, it may be washed off without detriment to the writing; which, however, may be renewed by a fresh application of the pumice-stone.

TO TAKE INK-SPOTS, &c., OUT OF BOUND BOOKS.

First clean the surrounding parts from grease with warm water; then apply oxalic acid with a camel-hair brush. To clean the entire cover, a solution of tin may be used. Finish by washing with cold water.

ARTIFICIAL GLAZING.

As a covering for flower beds, &c., nothing can be better than the varnish or solution of caoutchouc, spread with a clean brush upon fine holland, not calico. When the linen is properly strained upon frames, it is as tight as a drum-head, and is no contemptibie substitute for glass; indeed, its chastened light renders it sometimes preferable.

TO MAKE INDIAN INK.

Take of honey half a pound, the yolk of an egg, half an ounce of gum-arabic, and of the finest lamp-black a sufficient quantity to form the mixture into sticks or cakes.

COLOURING.

Nature employs but two metals, iron and copper, for colouring the whole creation. All her variety results from the varied combination of three colours, red, yellow, and azure. What a harmony is there in the rainbow! Take away but one of its principal colours, the red, for instance, and the harmony is gone. The ancient painters for a long time employed only these primitive colours; the moderns make use of a considerable number; but with these three, and the addition of black and white, eighthundred and nineteen combinations may be produced.

TO CLEAN GILT FRAMES, SOILED BY FLIES, &c.

When the gilders have finished laying the gold on a frame, they varnish it all over with a thin coating of very pure gum-arabic (dissolved in water), with a camel-hair pencil. Whatever dust collects is, therefore, on the gum, and not on the surface of the gold, and may be removed by moistening the gum with a camel-hair brush; any other article would be too rough, and damage the gold underneath. The proper way to do it is, after dipping the brush in clean water, to wet a small portion of the frame with it, so as to dissolve all the gum on that part; then wash your brush in the water, and draw it between your finger and thumb, or between a fold of sponge, to take out the superfluous water. With the brush thus prepared, you may carefully sweep off the wet gum and dirt together, without injuring the gold. When you have finished the whole frame, let it stand still the next day; you must then varnish it all over with a thin coating of the palest gum-arabic you can procure, dissolved in clean water, or the gold will neither be protected nor clean again.

TO CLEAN PICTURES.

Moisten a portion of the surface of your painting, about the size of the palm of the hand, with saliva or tepid water. Rub this about with your fingers a short time; then, with a piece of fine flannel or wash leather, rub the place till it is quite dry. This process you must repeat as long as you perceive the flannel or leather to get discoloured by the operation. If it be your intention to varnish the picture, after cleaning its surface as above described, get some whiting, put a portion of it on the palm of the hand, and moisten it well with water; rub it about with your fingers, to ascertain if it be free from particles of grit, that might injure the surface of the picture. When assured of this, apply it to the painting, and cover its entire surface, rubbing it gently about; remove it with a sponge or soft cloth, and let it remain till next day. By this process, every particle of a greasy nature will be displaced, and the picture will be in an excellent state for a coat of varnish. This should be done in a dry day, using mastic varnish, with a few drops of drying-oil. This is a

harmless process; whereas alkalies or other strong liquids, frequently used for the purpose, destroy the integrity of a picture, by removing or injuring the delicate glazings, which can never be restored.

TRANSPARENT VARNISH.

Take of gum sandarach, or juniper, half a pound; of Strasburg turpentine, three ounces; of spirits, two pints. Let them stand in a covered vessel till dissolved.

TO BREAK A STICK PLACED ACROSS A COUPLE OF GLASSES WITHOUT INJURING THE GLASSES.

Take two wine-glasses; place them one upon each of two tables of like height; fill them with wine or water; take a stick of about the size of a common broomstick, with its two ends pointed; place it across the glasses, so that an end shall rest on the edge of each; then take a heavy iron, like a kitchen poker, and with it give the stick a smart blow in its centre, and the stick will be broken, without in the least injuring the glasses, nor will a drop of the liquor in the glasses be spilled, if the feat be cleverly performed. But, on the contrary, if the stick were struck from the under side, so as to drive it up into the air, the glasses would infallibly be broken.

OIL FOR THE HAIR.

The following are the ingredients of the celebrated Macassar Oil:—Olive oil, 1 pound; oil of origanum, 1 drachm; oil of rosemary, 1 scruple. Mix them in a glass-stoppered bottle, and shake them well together.

TO RESTORE OBLITERATED WRITINGS.

To half a pint of pale sherry put six or eight of the whitest dyeing-galls, bruised; let them stand in the sun about five days, and then put them on the defaced writing, and it will almost immediately revive it.

SUMMER SALINE DRAUGHT.

Put 20 grains of corbonate of soda and 25 of tartaric-acid, or essence of lemon, to a teaspoonful of fine white sugar, and mix in a goblet of water, by pouring it from one glass to another.

TO BLEACH STRAW HATS.

First wash them with soap and water, and then place them for an hour in a box with some burning sulphur.

AROMATIC VINEGAR.

Put two ounces of acetate of potash into a retort, with its weight of sulphuric acid; distil, using a flask as a receiver, containing 1 ounce of water. Heat the retort by a lamp; and cool the flask by a basin of water. A solution of pure acetic acid will be obtained; if a minute quantity of camphor, a drop of the oil of lemons, and a drop of the oil of cloves, be added, the result will be what is usually sold as aromatic vinegar.

TO OBTAIN FLOWERS OF DIFFERENT KINDS ON THE SAME STEM.

Split a small twig of the elder-bush lengthwise, and having scooped out the pith, fill each of the compartments with seeds of flowers of different colours, but which blossom about the same time. Surround them with mould, and then, tying together the two bits of wood, plant the whole in a pot filled with earth. The stems of the different flowers will thus be so incorporated as to exhibit to the eye only one stem, throwing out branches covered with flowers analogous to the seed which produced them. If the plants have some affinity in the texture of their stems, and germinate at nearly the same period, less hazard will be run of the strong choking the weak.

TO FIX BLACK-LEAD PENCIL DRAWINGS.

Dissolve a small quantity of isinglass, and dilute it with warm water, till so thin that, when spread upon paper, and dry, it shall be free from those sparkling particles which never fail to appear, if too thick. Take a broad flat camel-hair pencil, set in tin, and fill it plentifully with the solution, and draw it slightly over the work intended to be fixed, once or twice, or according as the size of the picture may require: it must be very carefully done, to prevent disturbing the sharpness of the pencil work; when dry, it will be found to resist the effect of India-rubber. It is advantageous to sponge the back of the

paper or Bristol board before applying the solution, in order that the paper may dry level, as it is apt to contract round the edges when only one side is wet. If there be a margin round the drawing, it is not requisite to sponge the back. Milk and water answers the above purpose quite as well—so does alum-water.

TO CAUSE A BRILLIANT EXPLOSION UNDER WATER.

Drop a piece of phosphorus, the size of a pea, into a tumbler of hot water; and, from a bladder furnished with a stop cock, force a stream of oxygen directly upon it. This will afford a most brilliant combustion under water.

HOW TO MAKE A PEN FOR 100 SHEEP HOLD 200 BY THE ADDITION OF TWO MORE HURDLES.

In the original hurdle, or that which holds the hundred sheep, the pens must be so disposed that there shall be only one at the top and bottom. It is then obvious that if one hurdle more be placed at each end, the enclosed space must necessarily be doubled, and thus rendered capable of holding twice as many sheep.

TO SUSPEND A RING BY A BURNED THREAD.

Soak the thread in salt and water, suspend by it a ring not heavier than a wedding-ring, apply the flame of a candle; and, though the fabric of the thread will be consumed, the ash will still sustain the thread.

TO SET FIRE TO A COMBUSTIBLE BODY BY REFLECTION.

Place two concave mirrors at about twelve feet distance from each other, and let the axis of each be in the same line. In the focus of one of them place a live coal, and in the focus of the other some gunpowder. With a pair of strong bellows keep blowing the coal, and, notwithstanding the great distance between them, the powder will presently take fire.

The mirror may be either made of glass, metal, or pasteboard gilt.

TO IMITATE GROUND GLASS FOR RECEIVING AN IMPRESSION.

Take one pound of ground rice, and two quarts of soft

water; boil it it until it is of the consistence of cream; then strain it through muslin, and add to it twenty-four drops of spirit of turpentine; lay it on one side of the glass, and place it in an oven of moderate heat, and the landscape will be left on the glass in a very secure manner, and will bear washing with any acid.

METHOD OF TAKING THE IMPRESSION OF BUTTERFLIES ON PAPER.

Clip the wings off the butterfly, lay them on clean, in the form of a butterfly when flying. Spread some thick clean gum-water on another piece of paper, press it on the wings, and it will take them up; lay a piece of white paper over it, and rub it gently with the finger, or the smooth handle of a knife. The bodies are to be drawn in the space left between the wings.

TO TAKE PLASTER CASTS FROM LIFE.

Tie the back hair, by a cloth tied over it and around the face; then grease the face well, particularly the whiskers, eye-brows, and eye-lashes, with hog's-lard or butter. Lay the patient, and *patient* he must be, on a table or the floor, face uppermost, and surround the edge of the cloth with a *wall* of putty or dough, so that it shall rise upwards all round, as much as possible; then make two hollow long cones of paper, and put them in the nostrils, fastening them with the same dough, taking care that the whole nostril shall be thus filled up. This being ready, mix up some plaster of Paris in a basin, with *warm* water, and pour it over the face, the eyes and mouth of course being closed. The wall of putty will prevent a great part of it running off, and although this is not sufficient to retain the whole, yet, by the assistance of a knife, it may be taken up when a little set, and plastered on the nose and upper part of the face, until a perfect continuous surface or mould of plaster is produced. In a minute or two, the plaster will be sufficiently hardened to be taken off the face, and will form a mould, from which a cast like the original may be taken, by a reverse operation, greasing or soaping well the mould, and then pouring plaster into it. Some persons object to having their whole face done at once: if so, half may be operated upon first, and when this

half-mould is hardened, the edge of it is to be trimmed, greased, and put upon the face, while the other half is cast to it. The whole face may also be cast at once, and yet the mould separated in two pieces, thus:—Fasten on the face a fine silk cord, by a piece of wax stuck to the forehead, another to the tip of the nose, a third on the lip, and a fourth on the chin; the plaster being poured over the whole face, and suffered to remain till nearly set, the silk cord is to be pulled away, when the mould will be cut in half, and each half be easy of removal.

TO PRESERVE SEA-PLANTS.

These grow on the rocks from which the sea occasionally recedes; they are termed *fuci*, and when dried and preserved, are exceedingly beautiful; the *curious*, therefore, and especially those who prosecute the study of botany, must be anxious to know the best method of preserving them, without destroying their colour and beauty. The following is recommended by M. Mauduyt:—Take a sheet of paper, or rather of pasteboard, and cover it with varnish on both sides, and having rowed in a boat to the rock where the fucus abounds, plunge your varnished paper into the water, and detaching the fucus, receive it upon he paper, agitate the paper gently in the water, that the plant may be properly spread over it, and lift them up together softly out of the water; then fix down with pins the strong stalks, that they may not be displaced, and leave the plant lying upon the varnished paper, to dry in the open air: when it is fully dry, the different parts will retain their position, and the plant may be preserved within the leaves of a book. If you wish to free it from the slime and salt which adheres to it, it may be washed gently in fresh water, after being removed from the rock on which it grew.

TO TAKE IMPRESSIONS OF LEAVES, PLANTS, &c

Take half a sheet of fine wove paper, and oil it well with sweet oil; after it has stood a minute or two to let it soak through, rub off the superfluous oil with a piece of paper, and let it hang in the air to dry; after the oil is pretty well dried in, take a lighted candle or lamp, and move the paper over it in an horizontal direction, so as to

touch the flame, till it is perfectly black; when you wish to take off impressions of plants, lay your plant carefully on the oiled paper, and lay a piece of clean paper over it, and rub it with your finger equally in all parts for about half a minute; then take up your plant, and be careful not to disturb the order of the leaves, and place it on the book or paper, on which you wish to have the impression; then cover it with a piece of blotting-paper, and rub it with your finger for a short time, and you will have an impression superior to the finest engraving. The same piece of black paper will serve to take off a great number of impressions, so that, when you have once gone through the process of blacking it, you may make several impressions in a very short time.

The principal excellence of this method is, that the paper receives the impression of the most minute veins and hairs, so that you may obtain the general character of most flowers much superior to any engraving. The impressions may afterwards be coloured according to nature.

TO WRITE IN LETTERS OF GOLD.

Put some gum arabic into common writing-ink, and write with it in the usual way. When the writing is dry, breathe on it: the warmth and moisture will soften the gum, and will cause it to fasten on the gold leaf, which may be laid on in the usual way, and the superfluous part brushed off; or, instead of this, any japanner's size may be used.

MONEY DOUBLED BY OPTICAL ILLUSION.

Into a large drinking-glass, of a conical figure, (small at bottom and wide at the top,) put a shilling, and let the glass be half filled with water; then place a plate on the top of it, and turn it quickly over, so that the water may not escape. You will see on the plate a piece of coin the size of a half-crown; and a little higher up, another, the size of a shilling. But if the glass be entirely filled with water, the large piece only at the bottom will be visible.

This phenomenon is occasioned by your seeing the piece through the conical surface of the water, at the side of the glass, and through the flat surface at the top of the water, at the same time; for the *conical surface* dilates the rays, and makes the piece appear larger, whilst the *flat*

surface only *refracts* them, and occasions the piece to be seen higher up in the glass, but still of its natural size.

It will add to the amusement this experiment affords by giving the glass to any one in company (but who of course has not witnessed your operations), and desiring him to throw away the water, but save the two pieces: he will not be a little surprised at finding only one.

CAMELEON SPIRITS.

Put into a decanter some volatile spirit, in which copper has been dissolved, and it will produce a fine blue. If the bottle be stopped, the colour will disappear; but, when unstopped, it returns. This experiment may be often repeated, and the interest occasioned by the changes much increased, if you ascribe the change to the *material* with which the bottle may be stopped, or to some mysterious words pronounced at such changes.

TO MELT IRON INSTANTANEOUSLY.

Bring a bar of iron to a white heat, and then apply to it a roll of sulphur. The iron will immediately melt, and run into drops.

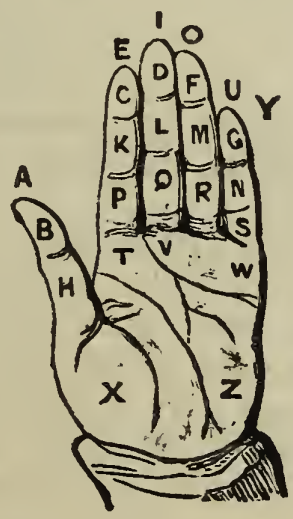
This experiment should be performed over a bason of water, in which the drops that fall down will be quenched. These drops will be found reduced into a sort of cast-iron.

ALPHABET

OF THE

DEAF AND DUMB.

THE Art of communicating ideas by spelling with the fingers, or by other signs, is called Dactylology. As early as the year 1584 there are records of men eminent for their learning and philanthropy having devoted their fortunes and abilities to the teaching of the Deaf and Dumb. It is therefore more than probable that, although we have no record of the fact, some system of conveying ideas by signs existed even at that early period. The German states were then the centre of civilization; and it was from them that our country first became impressed with its deep moral obligations to this peculiarly afflicted and dependent class of our fellow creatures. In 1680, Dalgarno, an Italian, who claimed the honour of being the first to publish a treatise on Dactylology, invented and made known in England a Manual Alphabet, in which the Vowels are represented by the tips of the fingers, and the Consonants by the various joints and sections of the palm, as shown below:—



The conversation was carried on by touching the position of the vowels with any finger of the right hand, and the consonants with the thumb of the same hand.

This, undoubtedly the first Manual Alphabet used in England, was the basis of the various systems of Dactylology now practised in this country and America. Some of these systems employ both hands, others only one. The latter mode is the one usually taught to the Deaf and Dumb in America. In our own country the two hands are used, in the forms represented in our engraving.

The Vowels are indicated by touching the thumb for *a*, the forefinger for *e*, the second or middle finger for *i*, the next for *o*, and the little finger for *u*.

The Consonants are thus formed:—

B.—Join the thumb and first finger of each hand, and place together the backs of the nails of the two forefingers.

C.—Form the letter as nearly as you can, with the thumb and fore-finger of the right hand.

D.—Form the letter by curving the thumb and fore-finger of the right hand, so as to resemble the bowl of the D, and placing the curve against the side of the left-hand fore finger, held perpendicularly.

F.—Place the fore-finger of the right hand across the two first fingers of the left hand.

G. and *J.* are both formed alike, by clenching each hand, and placing one, so clenched, upon the other.

H.—Draw the palm of the right hand across the left, from the wrist to the fingers' ends.

K.—Curve the fore-finger of the right hand toward the thumb, and place the second joint of the finger so curved against the back of the fore-finger of the left hand.

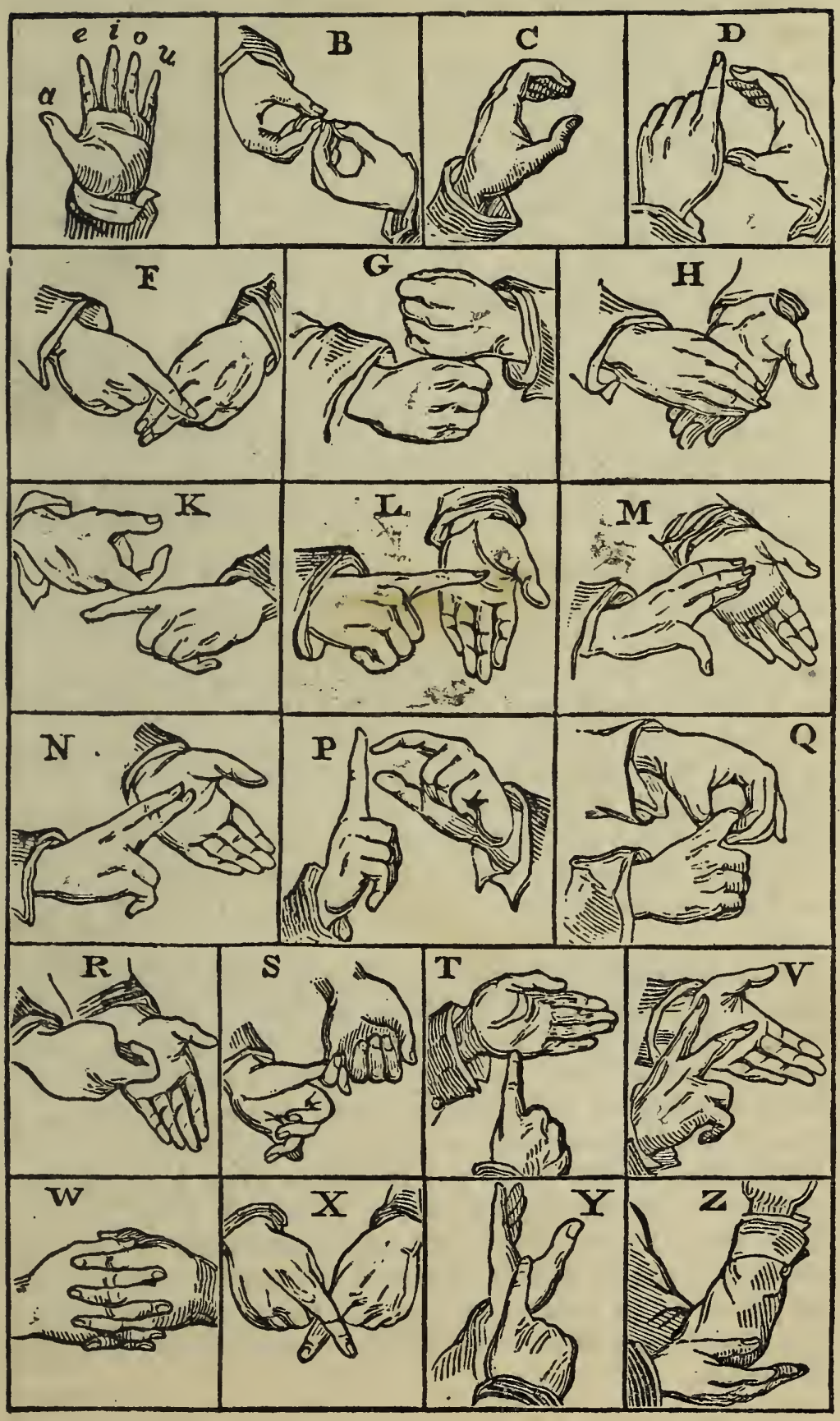
L.—Place the fore-finger of the right hand across the middle of the palm of the left, commencing at the under side, so that the end of the finger will lie between the thumb and fore-finger.

M.—Place the three first fingers of the right hand in the same way across the palm of the left.

N.—Place the two first fingers of the right hand in the same way across the palm of the left.

P.—Form the upper part of the letter with the thumb and fore-finger of the right hand, and place the curve against the two first joints of the fore-finger of the left hand.

Q.—Bring together the extremities of the thumb and fore-finger of the right hand; curve the fore finger of the left hand, and connect it with the right hand at the point where the fore-finger and thumb touch each other.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R.—Bend the fore-finger of the right hand into the form of the upper part of the letter, and lay it on the palm of the other hand.

S.—Bend the little finger of each hand into a semicircle, and link them together.

T.—Place the end of the fore finger of the right hand to the centre of the lower edge of the palm of the other hand.

V.—Form the letter V by extending the two first fingers of the right hand on the palm of the left.

W.—Join the hands, in the usual way of clenching them, by interlacing the fingers one within the other.

X. Cross the two first fingers of each hand.

Y.—Form the letter, by extending the thumb and fore-finger of the left hand, and placing the fore-finger of the right hand so as to form the lower line of the letter.

Z.—Place the elbow of the right arm in the palm of the left hand, and raise the right hand up nearly to touch the face.

For those who already possess, in speech, a means of communication more easy and more appropriate to all circumstances, Dactylology is little more than an ingenious puzzle; but not only to the Deaf and Dumb, but in an almost equal degree to the Blind, the art is invaluable. As it addresses itself to the sense of feeling as well as to that of sight, it is easy to touch another person's hand, if he be acquainted with the hand-alphabet, on such parts or portions as will enable him to comprehend the words or sentences delivered; and thus may conversation be carried on by the Blind, or by the Deaf and Dumb in the dark.

The delineation of figures in long numbers, through the agency of signs, has of late been carried to great perfection. The ordinary mode of Manual Notation was, for a great length of time, to typify the figures and ciphers by using the fingers and thumbs of both hands; but the system of Mr. O. Stansbury, formerly a Superintendent of the Institution for the Deaf and Dumb in New York, is not only more ingenious, but, being practised with the left hand only, has the important recommendation of leaving the right hand at liberty to record the pupil's calculations on paper or on a slate, and, as will be seen by the following description of it, is capable of marking any number of figures.

The cipher is represented by the closed hand. The thumb represents one, the other fingers being closed; the index-finger is added for *two;* the middle finger is raised for *three;* the fourth finger is added for *four;* the open hand represents *five;* the little finger alone is raised for *six;* the fourth finger is added for *seven;* the middle finger for *eight;* and the fore-finger is raised to the others for *nine.* Thus far for units. To indicate tens, the position of the hand is changed from perpendicular to horizontal; the thumb is pointed forwards for ten, the thumb and fore-finger for twenty, and so on to ninety. Hundreds are pointed downwards: thus—the thumb, fore-finger, and middle-finger, pointed downwards, represent 300. If 572 be the number to be designated, three positions of the hand are required: the five fingers are pointed downwards for 500, the little finger and fourth finger are pointed forwards for 70, and the thumb and fore-finger are held upright for two. During these changes the hand is kept in front of the body. To represent thousands, the left hand is placed across the body, towards the left shoulder, and the signs which were used in front for units, in this situation, represent thousands; keeping the hand in the same situation, and pointing forwards or downwards, tens of thousands or hundreds of thousands are exhibited. By changing the situation of the hand to the left shoulder, and by exhibiting the various positions of the fingers before described, millions, tens of millions, and hundreds of millions are expressed. The same positions, upright, forwards, and downwards, exhibited in other situations, may be applied to the expression of notations to any extent. Though rather complex in description, the whole is most easy and comprehensive in operation.

GYMNASTICS.

Gymnastic Exercises have the recommendation of not only improving, strengthening, and imparting grace to the muscular action, but, by giving the gymnast a proper knowledge of his physical capabilities, they inspire him with the confidence that constitutes the main essential for extricating himself or others from many situations of apparent danger. It is with great propriety, therefore, that a modified system of gymnastics has of late years become one of the subjects of school education.

In their broadest meaning, gymnastics comprehend every vigorous exertion of the muscles;—walking, running, jumping, hopping, vaulting, climbing, dancing, riding, wrestling, and swimming. Having already treated of the last, rejecting wrestling as a sport unsuited to gentlemen, and leaving riding and dancing to the professors usually resorted to for their attainment, we shall limit our attention to the other gymnastic exercises; and in dealing with them according to our limits, we shall dwell chiefly on the feats which may be performed with little or no apparatus, and without much risk of the accidents that have proved the only drawback to these otherwise desirable pastimes.

By way of preliminary caution, we may mention that Gymnastics should not be performed after a full meal; that the upper clothes should be removed, and put on again as soon as the sport is over, as a protection against catching cold; that boys should not attempt the more difficult feats till they have become thoroughly expert at the easier ones, and that they should never practise with knives, peg-tops, or other toys about their persons.

A play-ground covered with grass or loose sand, to prevent injury from an occasional fall, is desirable; and leaping-stand, horizontal bar or cord, parallel bars, a vaulting-horse, leaping-pole, and a climbing stand, with ladders of wood and rope, are the appurtenances of a complete gymnastic ground: but many of these are not essential to the moderate course of gymnastics which we

advocate, viz. walking, running, jumping, hopping, vaulting, balancing, and climbing.

WALKING exercises should in schools be practised in classes. The head and body should be kept erect; the stomach held in, the shoulders back, the knees straight, and the toes turned out. The arms should be allowed to swing freely by the side, the feet be but slightly lifted, and advanced parallel with the ground, and the tread made fully on the ball of the foot, not on the toes or heels. Three miles an hour is a fair walking pace for a lad; four miles is good walking for a man, although many by practice accomplish five miles per hour as their average pedestrianism, while prize walkers far exceed this rapid pace.

RUNNING,—should be done with an air of quietness, confining the action as much as can be to the legs, leaning the body somewhat forward, and keeping the respiration short. As in walking, the feet should not be raised far from the earth, and the tread should be made on the ball, not on the extremities of the feet. There should not be needless clothing, to obstruct the air. Where running in a circle is practised, the course should be occasionally reversed, that the two sides may be equally exercised. A mile in five minutes is good running; but there are runners who can accomplish four times the distance in the time.

JUMPING.—Bend the knees so as to bring the calves of the legs to the thighs, or the knees in a line with the thighs; spring from the toes; direct the arms towards the place to be jumped to, with a swing from behind; fall on the toes, not on the heels; hold the breath while performing the spring; incline the body forward as a safeguard against falling backward; let both feet come to the ground together; and, if there be a run to the leap, commence with short steps, increasing their velocity and length as the jump is neared.

HOPPING is springing over a space on the toes, and is practised either on one foot or the two. The *hop-walk*, as is called, is performed by placing the hands upon the hips, with the thumbs turned backwards or over the buttocks, and then springing forward on the balls of the toes of both feet, or of either alternately. For the *stooping-hop*, crouch down so as to bring the body close to the

calves of the legs, and then spring from the toes, as already directed, either perpendicularly, so as to alight on the same spot, or forward or backwaad, as may be agreed on. For the *springing-hop*, place the hands on the hips, raise the body upon the toes, and fling the feet up alternately behind, so as to strike the thighs; then vary it by throwing up both feet behind at the same time. Another springing-hop is made by drawing the knees up to the breast, after the spring is taken, keeping the head and shoulders perfectly upright, but inclining the body a little, to meet the raised knees.

Leaping should not be attempted till tolerable proficiency has been attained in running, jumping, and hopping, as it is by the judicious continuation of these movements that good leaping is to be accomplished. Leaping is made either over heights, from heights, or along distances. The latter is designated the *long leap*, and is made either with or without a run. If done in the latter way, the feet should be closed, and the spring made from the toes. If made with a run, let the run be from ten to twenty paces, made in quick small paces, and spring from one foot or both, as agreed. In either case, while springing, throw the arms out, incline the body forwards, and let the descent, if possible, be effected on both feet. The *deep leap* can be best practised from a flight of steps, as they enable the party to increase his task as he acquires skill or confidence. The feet should be placed together, the body stooped, and the hands extended, so as to catch the ground, if necessary to protect the head; but coming down on all fours is not to be called leaping. On no account, however, let the gymnast be over tasked with this leap, or allowed to make it on his heels, as the concussion may injure the brain. For the *high leap*, it is desirable to have a rope extended from two uprights, and so slightly held taught by balance-weights, that it will readily give way if caught by the leaper's foot. It may be performed either standing or with a run, according to our directions for the long leap.

Parallel Bars.—With the assistance of a couple of horizontals, fixed on uprights, as represented in our engraving, various exercises may be performed that are calculated to develop and invigorate the muscles of the arms and chest. The first thing is to raise the body on

the hands, as shown in the plate. The body may then be swung backward and forward, till by practice the toes be brought in a line with the nose. Next, the gymnast may learn to leap over one side of the bars while in full swing, by quitting the hold of one hand, while by muscular exertion he casts his body over the bar on which the other is still fixed as a fulcrum, and thus alights on his feet. Various other feats may be performed on the parallel bars, which will be suggested by practice.

Horizontal Bars.—The first thing is to place the hands on the near side of the bar, and learn to elevate the body to its centre while in this position. Then reverse the hands to the other side of the pole, and repeat the experiment. When well practised in the art of hanging by the hands, the feet may be brought into play by raising first one and then both on to the pole, while the body is suspended by the hands; and thus, after a while, will be acquired the art of turning somersets and effecting other manœuvres on the horizontal bar.

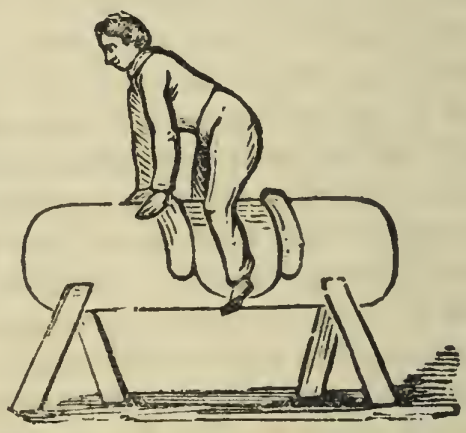
Balancing.—In gymnastics, balancing consists in standing on one leg, and performing various feats while thus poised: such as taking the raised leg in one or both of the hands, and carrying the foot to the mouth or the back of the head, laying it on the shoulder. Another exercise is performed by extending the arms, raising one leg from the ground, sitting down, and recovering the perpendicular, without the use of the hands or the elevated leg. In some gymnastic grounds, a balancing-pole is fixed in a horizontal line at a slight elevation, on

which the pupil, after some little guiding in the first instance, may speedily learn to walk, at first forward, then backward, and ultimately with the arms crossed, either in front or behind.

WALKING ON STILTS will come easy to those who have familiarized themselves in the exercises enumerated.

LEAPING WITH A POLE, as commonly practised by the peasantry of the Pyrenees, is done by taking hold of the pole at about the height of the head with the right hand, in the line of the hips with the left, placing the pole midway in the distance to be leaped, at the same instant making a spring with the right foot, and letting the body pass to the left of the pole, so as to alight with the face towards the space leaped from. *To leap into a hole, or from a height*, requires considerable practice and strength of arm. The gymnast is to place the pole on the spot to be reached, to grasp it with both hands, to let his hands slide down till his head is nearly in a line with his legs, then to withdraw his feet from their position, and, swinging round the pole, descend on the balls of his toes, with his face towards the spot he started from.

VAULTING requires an instrument called a vaulting-horse, as depicted in our engraving. It consists of a



piece of timber, circular at the top and at each end, firmly supported on four legs. In the centre, what is called the saddle is formed by two ridges, so placed as to leave convenient sitting-room between them. The ends and centre may be covered with leather, and stuffed with wool; or a leather case similarly stuffed may be made to fasten with buckles on any part of the horse. Leaping on to it is first to be practised, by placing the hands close together

on one end of the horse, and springing on to it astride. This acquired, learn, instead of opening the legs so as to straddle the horse, to bring them up close together after the hands, and, with a little practice, you will be able to raise the body, and thus stand erect upon the horse. *To vault into the saddle*, place the hands on one of the ridges, and at the same time make a spring, turning the body simultaneously to one side, so that one leg may pass over, and thus seat you in the saddle. This may be done either with or without a run. *Vaulting sideways* is done by placing the hands as already directed, making a spring sufficient to throw both feet over the back, and then abandoning the hold of the hand so as to alight on the balls of the toes on the other side. *To vault on to or over the saddle*, place a hand on each side, and proceed as directed for the other leaps.

Climbing the Rope.—Placing one hand above the other on the rope, grasp it also with the feet, by crossing the legs at the ankles. As you lift one hand above the other alternately, draw the feet up between each movement, so as to make them do their share in sustaining your weight. Sailors, however, instead of crossing the legs, pass the rope between their thighs, and bringing it across the calf of the leg, thus get it within the pressure of the feet. There can be little doubt of this being the most quick and certain mode of climbing the rope, but it is more likely to fray the clothes than the other, and therefore not so suitable to the play-ground. In descending the rope, be careful to shift the hands as directed for climbing, and not to let the rope slide through them, as the friction is likely to lacerate the hands. The slanting rope is climbed and descended by precisely the same action, and is easier to begin with than the perpendicular.

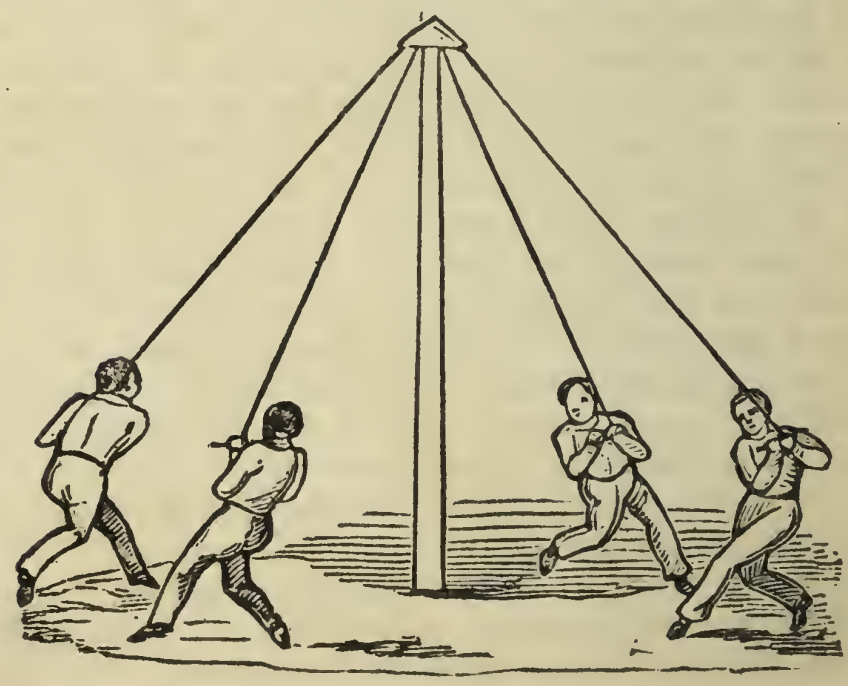
Climbing the Pole is done by encircling it with the legs and grasping it with the hands, as is done with the rope, with this difference, that the hands must not be shifted one over the other, but slid up together, alternately with the legs. To descend the pole, relax the hold, without letting go with either hands or feet, and thus slide gently down.

Climbing the Ladder.—As a gymnastic exercise, this is to be done from the under part, taking hold either by the sides or the rundels of the ladder. The hands

are of course to be moved up alternately, to accomplish which let the player bring the elbow of the lower arm as near down to the ribs as he can while lifting the other arm to the next rundel.

CLIMBING THE PLANK.—Place the plank at about the same angle as a ladder, or not so slanting, according to the strength or skill of the performer. The plank should be at least two inches thick, or it will have too much spring, and of about the same width. Place a hand on each side, the feet flat in the centre of the plank, and progress by moving each alternately. Descend by short quick steps.

FLYING STEPS, OR GIANT'S STRIDES—An engraving of this, the most exhilarating of gymnastic exercises, is placed at the end of this chapter. It cannot be practised without the apparatus therein delineated, which consists of a mast or beam firmly fixed in the ground, with a strong iron cap on the top, made to turn freely on a pivot. From this depend four or more ropes, with a stick or bar at the end of each. Of these each player takes hold of one, and they then all vault off together in a circle, increasing their speed as they progress, till the impetus carries them through the air with great rapidity, almost without an effort. Indeed, when in full action, the knees may be drawn up to the breast, and the motion will go on, notwithstanding, for a considerable period.

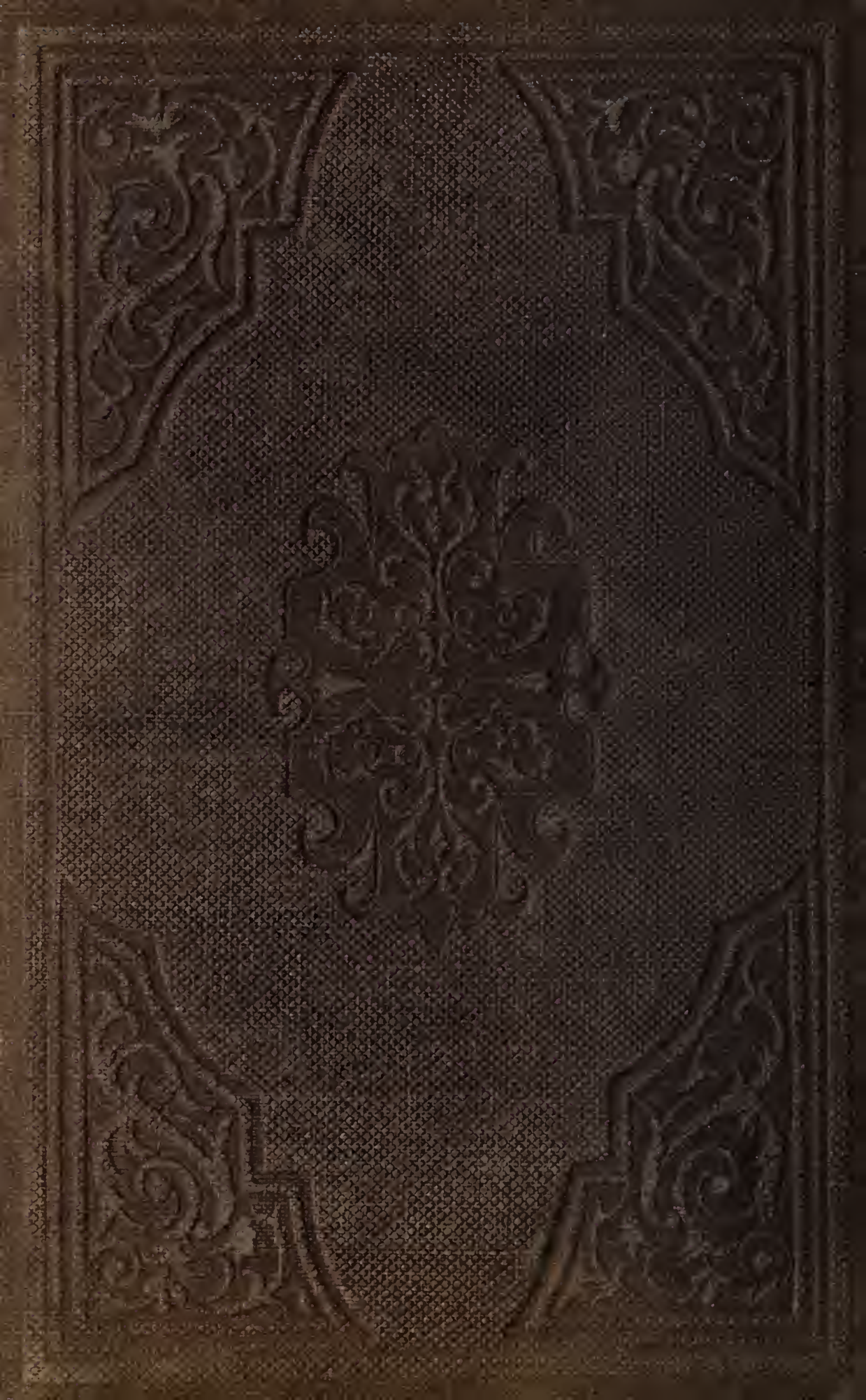


THE END.

Sympathetic Ink —

Black —

Write with a solution of Green Vitriol, & wash with tincture of galls.

Blue —

Write with nitrate of Cobalt & wash with Oxalic Acid.